LOCKHEED BRAKE

Regd. Trade Mark

service manual

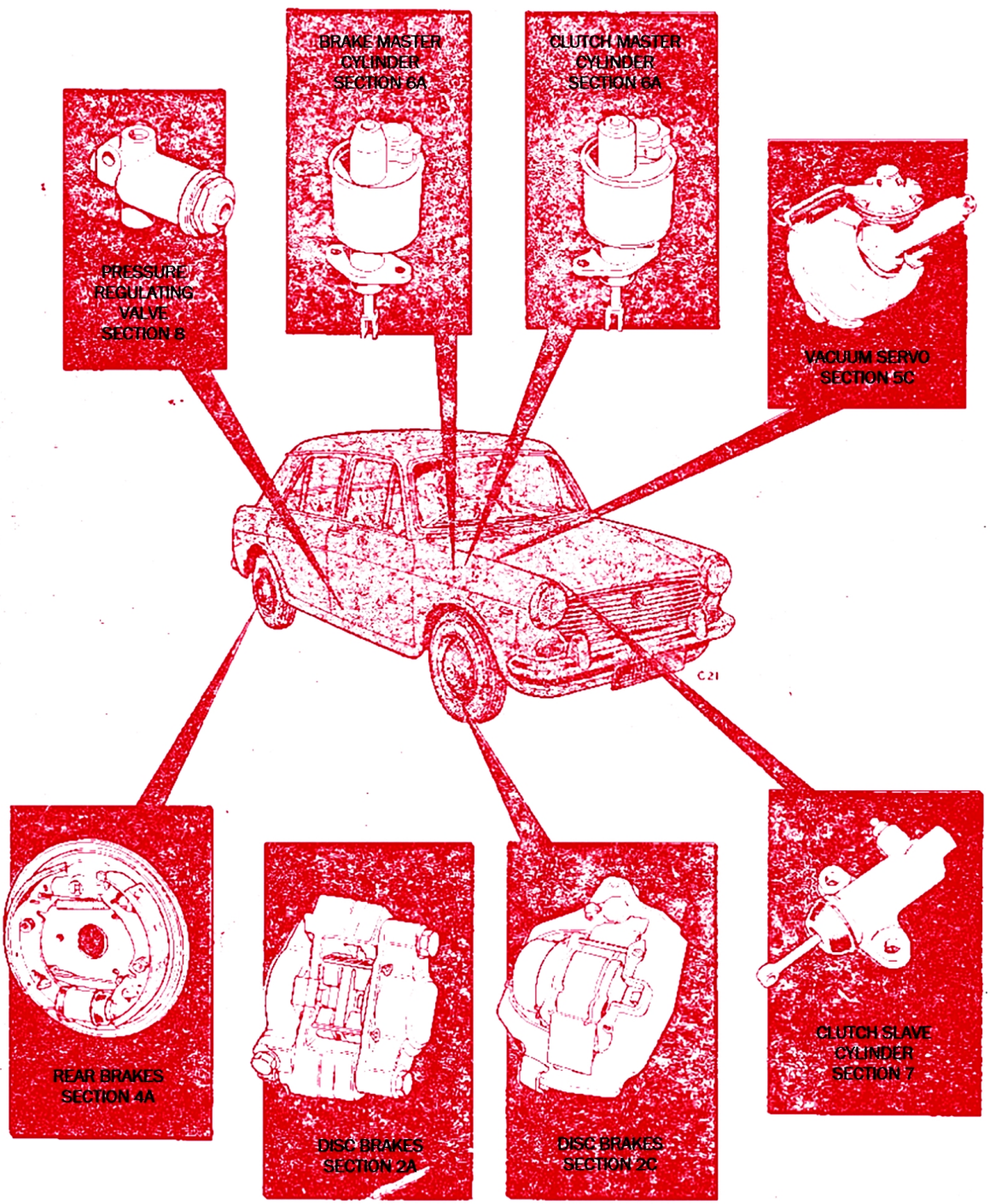
AUTOMOTIVE PRODUCTS CO. LTD., P.O. BOX 14, SOUTHAM RD. BANBURY, OXFORDSHIRE
Telephone: BANBURY 4421. Telex No. 83106. Telegrams: "AUTODUCTS" BANBURY, TELEX.

LOCKHEED

hydraulic equipment on the

BLMC 1100 MKS I & II & 1300 MODELS

(inc. GT ESTATE & automatic versions)



SEE OVERLEAF FOR BRAKE ADJUSTMENT PROCEDURE

BRAKE ADJUSTMENT

FRONT DISC BRAKES

These are self adjusting; accordingly no means of adjustment is necessary or provided.

REAR BRAKES

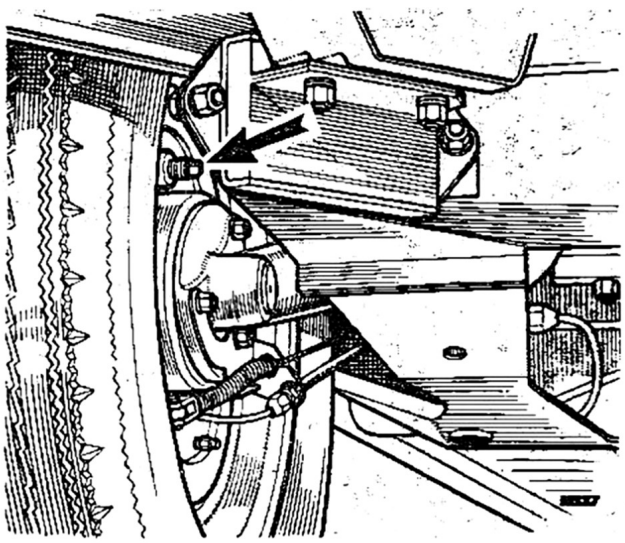
Whenever brake adjustment is carried out on this type of brake, it is recommended that the exposed threads of the adjuster stem are well coated with Shell Corrosion Resistant Grease SB2628 or PolyButylCuprysil (PBC)* to give increased protection against corrosives such as salt thrown up from the road. Accordingly, all adjustment should be backed off and grease applied to the exposed threads of the adjuster stems with a small brush. Adjust the brakes by turning the adjuster stem in a clockwise direction as viewed from the inboard side of the backplate until the drum is locked. Back off just enough to allow the drum to revolve freely.

Apply the footbrake firmly to centralise the shoes. Recheck for correct adjustment.

Repeat the above sequence for the other brake assembly on the axle.

Where necessary, adjust the handbrake linkage as detailed by the vehicle manufacturer.

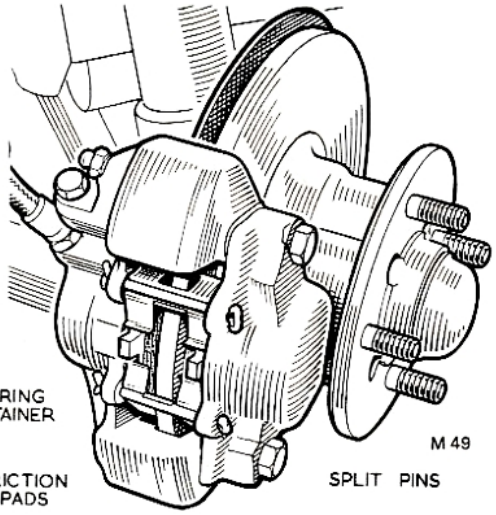
*PolyButylCuprysil (PBC) is an anti-seize lubricant and protective, manufactured by K. S. Paul Products Ltd., Nobel Road, London N.E.18.



ROUTINE MAINTENANCE Refer to the Servicing Summary and Notes on Routine Attention at the end of Section 1.

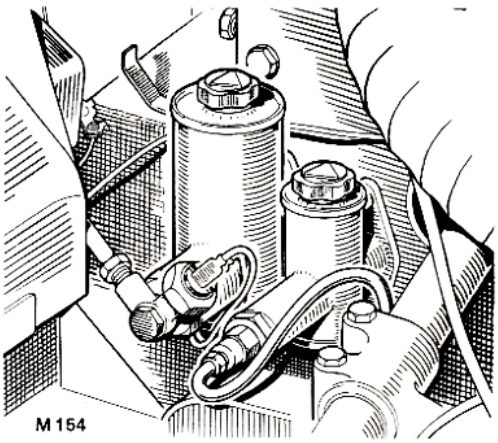
LOCKHEED
servicing summary

SECTION 1



EVERY 1,000 MILES
OR 1 MONTH

CHECK FLUID LEVEL

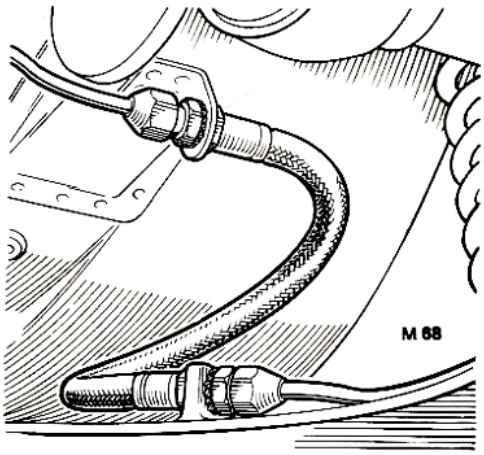


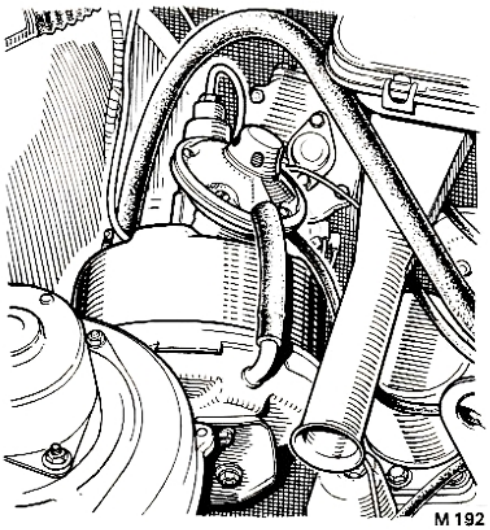
EVERY 5,000 MILES
OR 3 MONTHS

CHECK FRICTION PADS AND LININGS

EVERY 10,000 MILES
OR 6 MONTHS

CHECK FLEXIBLE HOSES AND METAL PIPES



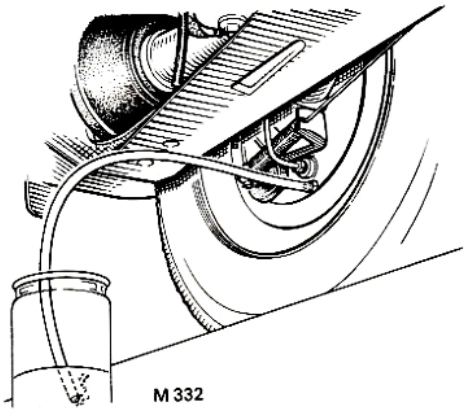


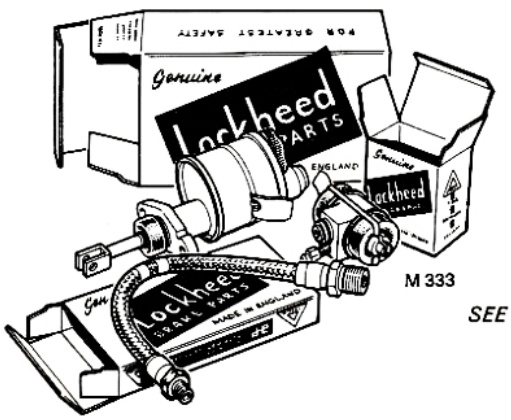
EVERY 12,000 MILES
OR 12 MONTHS

CHECK SERVO AIR FILTER

EVERY 24,000 MILES
OR 18 MONTHS

REPLACE HYDRAULIC FLUID





EVERY 40,000 MILES
OR 3 YEARS

COMPLETE OVERHAUL

SEE OVERLEAF FOR NOTES ON ROUTINE ATTENTION

notes on routine attention

BRAKE AND CLUTCH MASTER CYLINDER SUPPLY TANKS

EVERY 1,000 MILES OR AT EVERY MONTH INTERVAL (whichever occurs first), the fluid level in the master cylinder supply tank must be checked and replenished where found necessary.

Before unscrewing the filler cap, clean the surrounding area to prevent foreign matter from entering the tank when the cap is removed. The level of the fluid should be $\frac{1}{4}$ in. below the threads for the filler cap. Great care must be taken to avoid spilling brake fluid on the bodywork of the vehicle, as the fluid is injurious to paintwork. Replace the filler cap, and tighten firmly. If LOCKHEED Super Heavy Duty Brake Fluid or LOCKHEED Disc Brake Fluid is specified by the vehicle manufacturer, no other fluid must be used for topping up. Failure to comply with this instruction cancels all guarantees of LOCKHEED equipment fitted to the vehicle. If a vehicle is equipped with disc brakes, the need to top up the fluid supply tank will be more frequent owing to caliper piston displacement caused by wear of the friction pads. On vehicles fitted with front and rear drum type brakes, topping up with fluid would normally be required only at long intervals. Nevertheless, a rapid fall of fluid level is indicative of a leak in the system which should be rectified without delay. To check for leaks, apply firm pressure to the pedal whilst an assistant inspects the unions, pipes, hoses and fittings. Examine again with the system at rest.

Cleanliness of the filler cap is essential. Blockage of the air vent in the cap causes brakes to drag or the clutch to slip.

BRAKE LININGS AND DRUMS

EVERY 5,000 MILES, examine the linings and fit new shoes if the linings have worn to one-third of their original thickness. Check brake drums for wear and cleanliness, and make sure that the linings are not contaminated with lubricating oil, grease or brake fluid.

FRICTION PADS

EVERY 5,000 MILES at least, friction pads should be examined for wear and renewed before the friction material has worn to a minimum thickness of $\frac{1}{16}$". If the thickness of material is approaching this dimension on either pad, it must be established that there is sufficient life left to withstand the next service period. Never allow lubricants or brake fluid to contaminate the friction pads.

CHECKS FOR FLUID LEAKAGE

When inspecting brake linings and friction pads, also check for fluid leakage from the wheel cylinder assembly or disc brake caliper. Rectify immediately if found faulty.

HOSES AND METAL PIPES

EVERY 10,000 MILES, the hoses should be examined for signs of leakage, chafing or general deterioration. If there is doubt, renew the hose. Nevertheless, all hoses should be renewed at least every 3 years or 40,000 miles, whichever occurs first.

When the hoses are being examined, check all metal pipes for looseness and corrosion. Rectify or renew as necessary.

VACUUM SERVO AIR FILTER

EVERY 12,000 MILES OR EVERY 12 MONTHS, the servo air filter should be removed and examined. Renew where found necessary. The filter may be cleaned by blowing through with a **low** pressure air blast. **Do not lubricate the filter.**

CHANGING THE FLUID

EVERY 24,000 MILES OR 18 MONTHS (whichever occurs first), the fluid should be drained completely from the system. Refill with new LOCKHEED hydraulic fluid of the type specified by the vehicle manufacturer. Scrupulous cleanliness must be observed during this operation, particularly taking care that no container or dispenser used for filling the system is contaminated with other matter or old hydraulic fluid.

Brake fluid, especially disc brake fluid, absorbs water from the atmosphere. It is therefore essential that exposure of the fluid be limited to the time taken to fill the system.

OVERHAUL

EVERY 40,000 MILES, OR 3 YEARS, or at each third lining or friction pad change (whichever occurs first), the master cylinders, wheel cylinders, vacuum servo, pressure regulating valve and clutch slave cylinder should be renewed, using genuine LOCKHEED replacement assemblies manufactured by Automotive Products Company Limited.

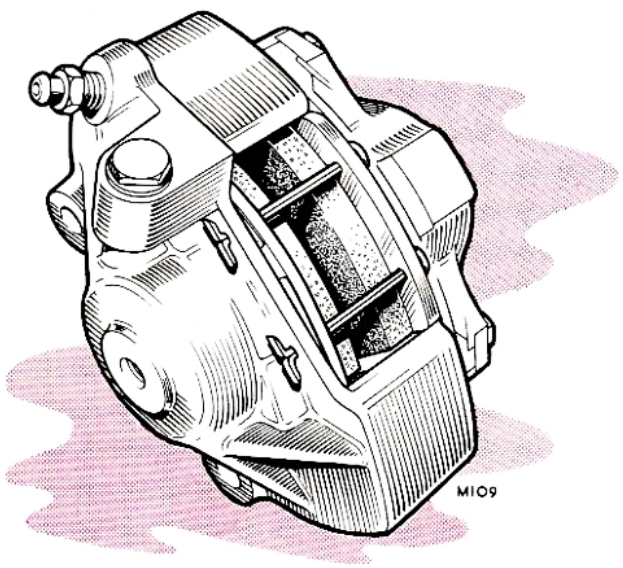
If rebuilding of the old assemblies is resorted to, all rubber parts, including hoses, must be renewed, but it is stressed that such renovation should only be carried out where all metal parts, particularly cylinder bores, pistons, etc., are found to be in **perfect** condition.

TROUBLE DIAGNOSIS

	VEHICLE FITTED WITH DRUM BRAKES	VEHICLE FITTED WITH DISC/DRUM BRAKES	VEHICLE FITTED WITH DIAPHRAGM SERVO	VEHICLE FITTED WITH PISTON TYPE SERVO
Pedal Travel Excessive	Shoes require adjusting. Air in system. Leakage past master cylinder main cup. Check also fluid level in supply tank, push rod adjustment, and examine system for leaks.	Shoes require adjusting. Disc running out of true. Air in system. Leakage past master cylinder main cup. Check also fluid level in supply tank, push rod adjustment, and examine system for leaks.	Internal fluid leak. (Loss of fluid from supply tank but no visible external leak).	Internal fluid leak. (Loss of fluid from supply tank but no visible external leak).
Pedal Feels Springy	Linings not bedded in. Brake drums weak or cracked. Check also master cylinder mounting for looseness or flexing.	Linings not bedded in. Brake drums weak or cracked. Check also master cylinder mounting for looseness or flexing.		
Pedal Feels Spongy	Air in system. Leak in system. Leak past master cylinder main cup.	Air in system. Leak in system. Leak past master cylinder main cup.	Internal fluid leak. (Loss of fluid from supply tank but no visible external leak).	Internal fluid leak. (Loss of fluid from supply tank but no visible external leak).
Pedal Feels Hard or Brakes Inefficient	Oil or brake fluid on linings. Linings glazed. Check also that linings are correct, type, bedded in, and that no wheel cylinder pistons are seized.	Oil or brake fluid on pads or linings. Linings, pads or discs glazed. Check also that pads and linings are correct type and bedded in, and that no caliper or wheel cylinder pistons are seized.	Low output from servo. Check for faulty non-return valve, restricted vacuum pipe or blocked air filter. Air leak into vacuum shell.	Low output from servo. Check for faulty non-return valve, restricted vacuum pipe or blocked air filter. Boost piston requires lubricating. Air leak into vacuum shell.
Brakes Drag or Fail to Release	Pedal push rod adjustment incorrect. Handbrake mechanism over adjusted or seized. Cups or seals swollen due to fluid contamination. Wheel cylinder piston seized. Master cylinder by-pass port blocked. Check also that pull off and pedal springs are not weak or broken and that supply tank is not overfilled.	Pedal push rod adjustment incorrect. Handbrake mechanism over adjusted or seized. Cups or seals swollen due to fluid contamination. Wheel cylinder or caliper piston seized. Master Cylinder by-pass port blocked. Check also that pull off and pedal springs are not weak or broken and that supply tank is not overfilled.	Air valve piston sticking. Push rod out of adjustment (if adjustable type).	Air valve piston sticking. Boost piston requires lubricating. Damage to vacuum shell causing piston to stick.
Unbalanced Braking	Oil or brake fluid on linings. Distorted drums. Different grades of lining material used. Check also brake backplate fixings, road springs, tyre pressures and steering connections.	Oil or brake fluid on pads or linings. Distorted discs or drums. Different grades of lining or pad material used. Check also brake backplate and caliper fixings, road springs, tyre pressures and steering connections.		
Brake Judder	Distorted drums. Loose backplate. Worn wheel bearings.	Distorted discs or drums. Loose caliper or backplate. Worn wheel bearings.		Boost piston requires lubricating.
Rapid Wear	Scored drums. Seized wheel cylinder piston. Wrong grade of linings fitted. Check also items listed under "Brake Drag".	Scored discs or drums. Seized caliper or wheel cylinder piston. Wrong grade of pads or linings fitted. Check also items listed under "Brake Drag".		

LOCKHEED
disc brakes - light duty

SECTION 2A



DESCRIPTION

LOCKHEED hydraulic disc brakes in the light duty range are of similar basic design. A mounting half and a rim half bolted together straddle the vehicle's brake disc, and house two self-adjusting pistons which operate friction pads against the respective sides of the disc. The assembly is known as a caliper.

On application of the foot pedal, brake fluid from the master cylinder passes under pressure to the mounting half of the caliper. An internal fluid passage connects with the rim half, thus both pistons move their friction pad simultaneously into contact with the disc.

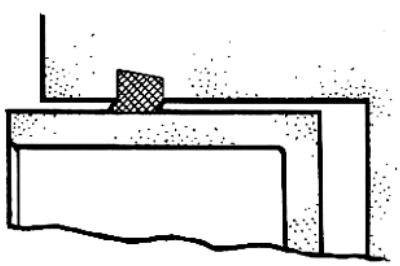
The friction material is bonded to a steel pressure plate to form the friction pad assembly. The pad is located adjacent to each piston in a recess within the caliper. The friction pads on some calipers are held within their recesses by retaining springs kept in position by split pins, whilst on others the pads are retained by split pins only.

A shim is fitted between the piston face and the pressure plate of the friction pad on some models; most pistons, however, have approximately one-third of their bearing face relieved. The purpose of the shim and relieved face of the piston is to eliminate brake squeal.

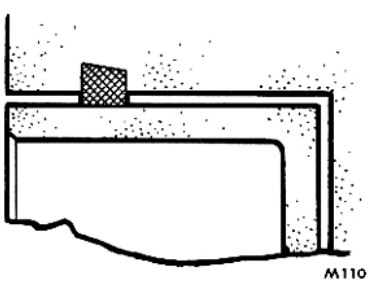
Care must be taken to ensure that the piston, shim and friction pad are positioned correctly on reassembly. As the relative position of the relieved face of the pistons varies according to specific vehicle application, take special note before removal.

A rubber seal fitted in a groove in each caliper bore prevents the brake fluid from leaking past the piston. Outward movement of the piston also causes the seal to flex. This elasticity and the shape adopted by the seal retracts the piston into the bore when the foot brake is released but only enough to maintain a correct running clearance between the friction pad and the disc. Progressive wear of the pads in service is therefore compensated automatically.

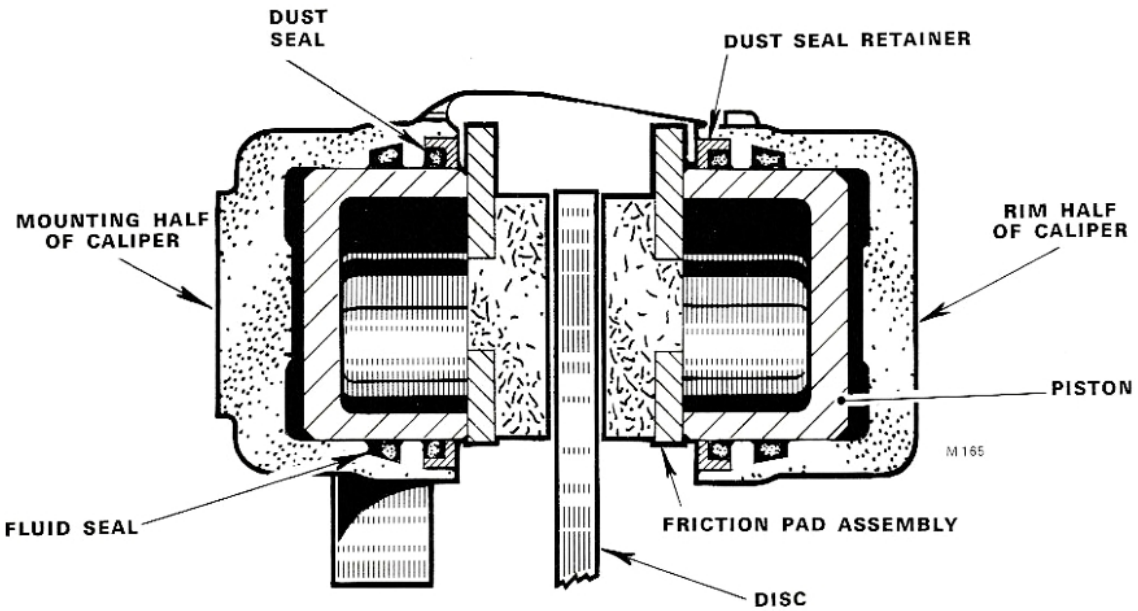
A rubber wiper/dust seal and retainer fitted at the mouth of the bore excludes dirt and moisture.



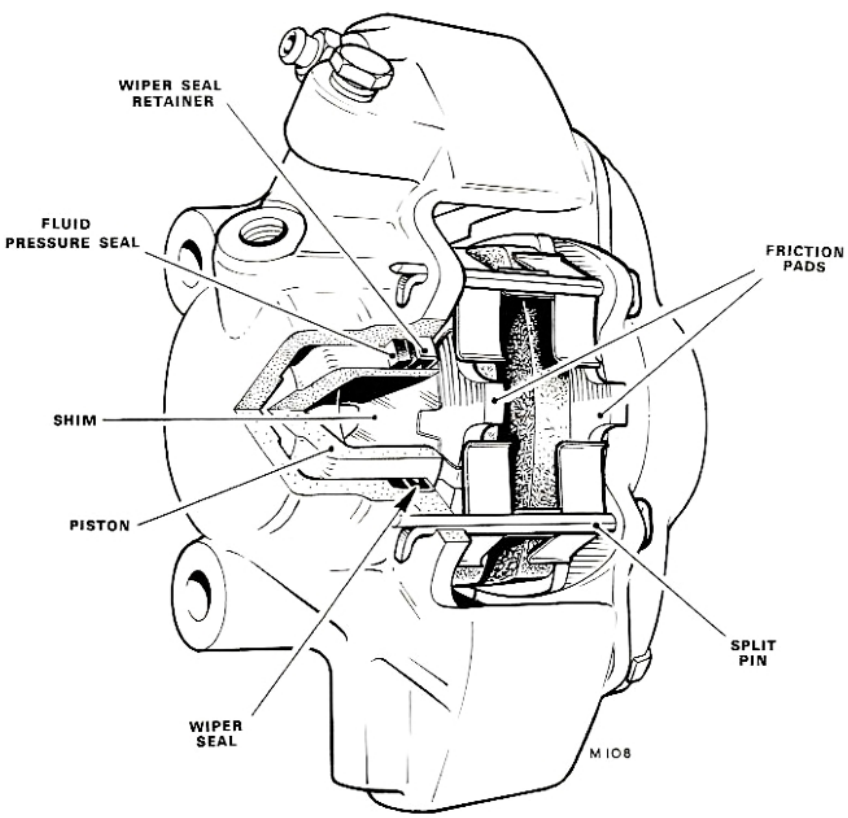
Position of the seal during outward movement of the piston.



Position of the seal, piston retracted.



SECTION THROUGH CALIPER



renewing the friction pads

SECTION 2A

Replacement of the friction pads is a simple process, made easier by the use of a piston clamp (Fig. 1). Two types of clamp are obtainable through vehicle distributors or from the manufacturers, Messrs. V. L. Churchill. The clamp suitable for the smallest caliper of the range has no separate distance piece, which is included with the larger clamp and is used for the the fitting of piston wiper seals and retainers on other calipers.

There is no need to separate the halves of the caliper to renew the pads.

The friction pads are supplied, in kit form for the two caliper assemblies of an axle, by all Automotive Products Company Limited stockists. **Always renew the pads of both calipers of an axle, otherwise unbalanced braking will result.**

Having removed the road wheel, depress the pad retaining spring or springs where fitted, and withdraw the split pins.

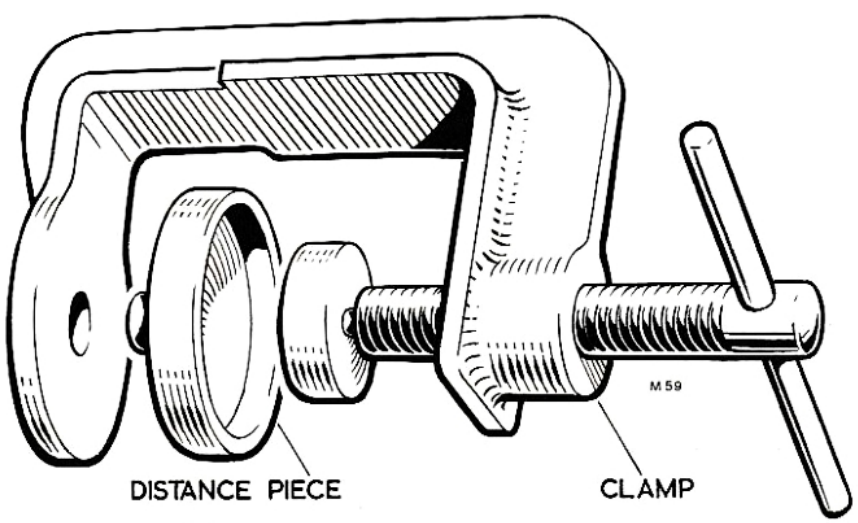
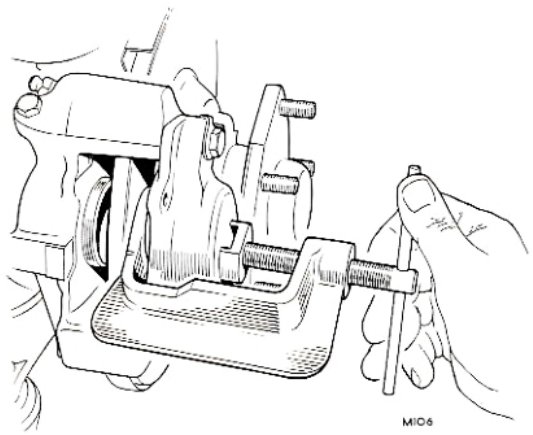
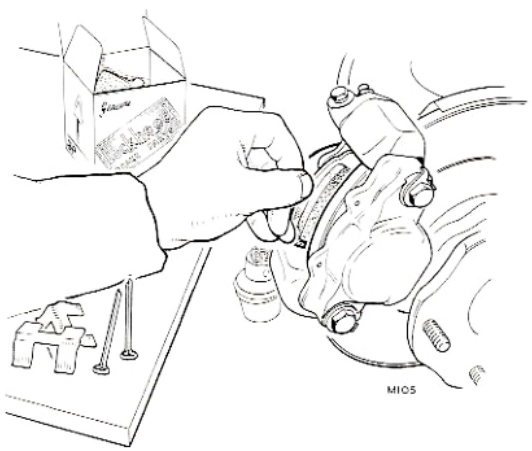


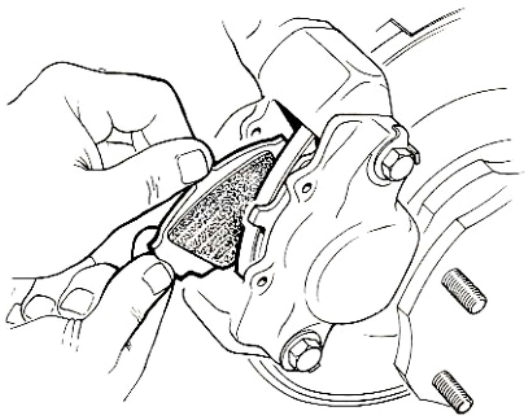
FIG. 1

Lift the pads out of their recesses in the caliper together with the shims where fitted. Note the position of each pad in the caliper if it has offset friction material, and also the location of the shim. Provided they are undamaged and not corroded, the shims need not be renewed.

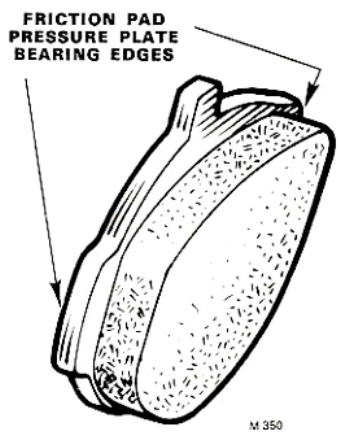


The friction pad recesses and the exposed part of the pistons must then be cleaned thoroughly. Only clean brake fluid must be used on the pistons. Provided the surface finish of the pistons is undamaged, lightly smear the faces and pad recessses with LOCKHEED Disc Brake Lubricant, and press each piston back into the caliper bore using the clamp. During this operation, brake fluid will be displaced into the brake master cylinder supply tank. Care should be taken to prevent overflow by lowering the level of fluid in the supply tank. In practice, this is best done by opening one of the bleeder screws to release excess fluid whilst the foot pedal is being depressed and then retightened at the end of the down stroke of the pedal.





Check the bearing edges of the new friction pads for blemishes. High spots on the steel pressure plates may be rectified by carefully filing the metal. Lightly smear the metal to metal contact edges of the pressure plate with LOCKHEED Disc Brake Lubricant, carefully avoiding the friction material.



Insert the new pads, and shims if fitted, into the caliper recesses. Fit new pad retaining springs where applicable. Replace the split pins.

Depress the foot brake pedal firmly several times to locate the friction pads correctly, and finally, restore the level in the master cylinder supply tank using the appropriate LOCKHEED brake fluid.

renewing caliper piston seals

SECTION 2A

Provided the following equipment is at hand, the process is straightforward:

The appropriate clamp for the type of caliper obtainable through vehicle distributors or direct from the manufacturers, Messrs. V. L. Churchill.

The appropriate LOCKHEED disc brake repair kit supplied by Automotive Products Company Limited stockists. Each repair kit caters for **one** caliper assembly.

A small quantity of LOCKHEED Disc Brake Lubricant.

A supply of the specified LOCKHEED brake fluid.

A supply of Ethyl Alcohol (Industrial Methylated Spirit).

THE PISTON SEALS CAN BE REPLACED WITHOUT SEPARATING THE TWO HALVES OF THE CALIPER. IF SPLITTING OF THE ASSEMBLY IS ABSOLUTELY UNAVOIDABLE, THE INSTRUCTIONS GIVEN IN THE APPENDIX AT THE END OF SUB-SECTION 2B MUST BE FOLLOWED.

Having removed the road wheel, release the caliper unit from the mounting bracket, and support the assembly to avoid straining the attached fluid hose.

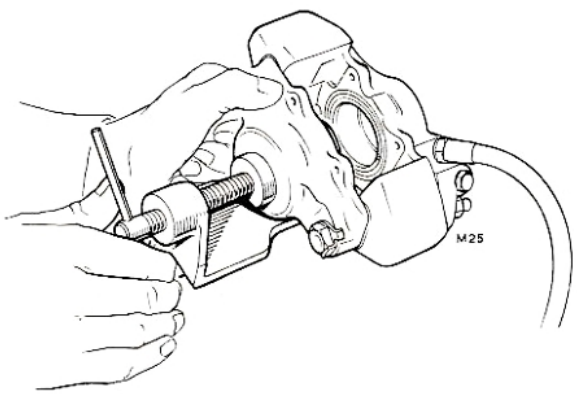
Depress the friction pad retaining spring or springs if fitted, and extract the split pins.

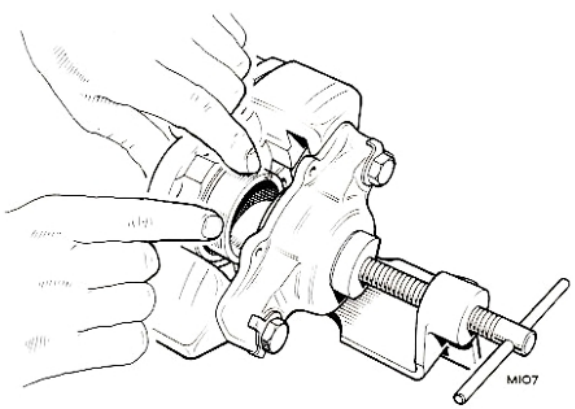
Lift the pads out of their caliper recesses together with the shims where applicable. For the purpose of correct reassembly, take note of the position of each pad in the caliper if it has offset friction material, and also note the location of the shim.

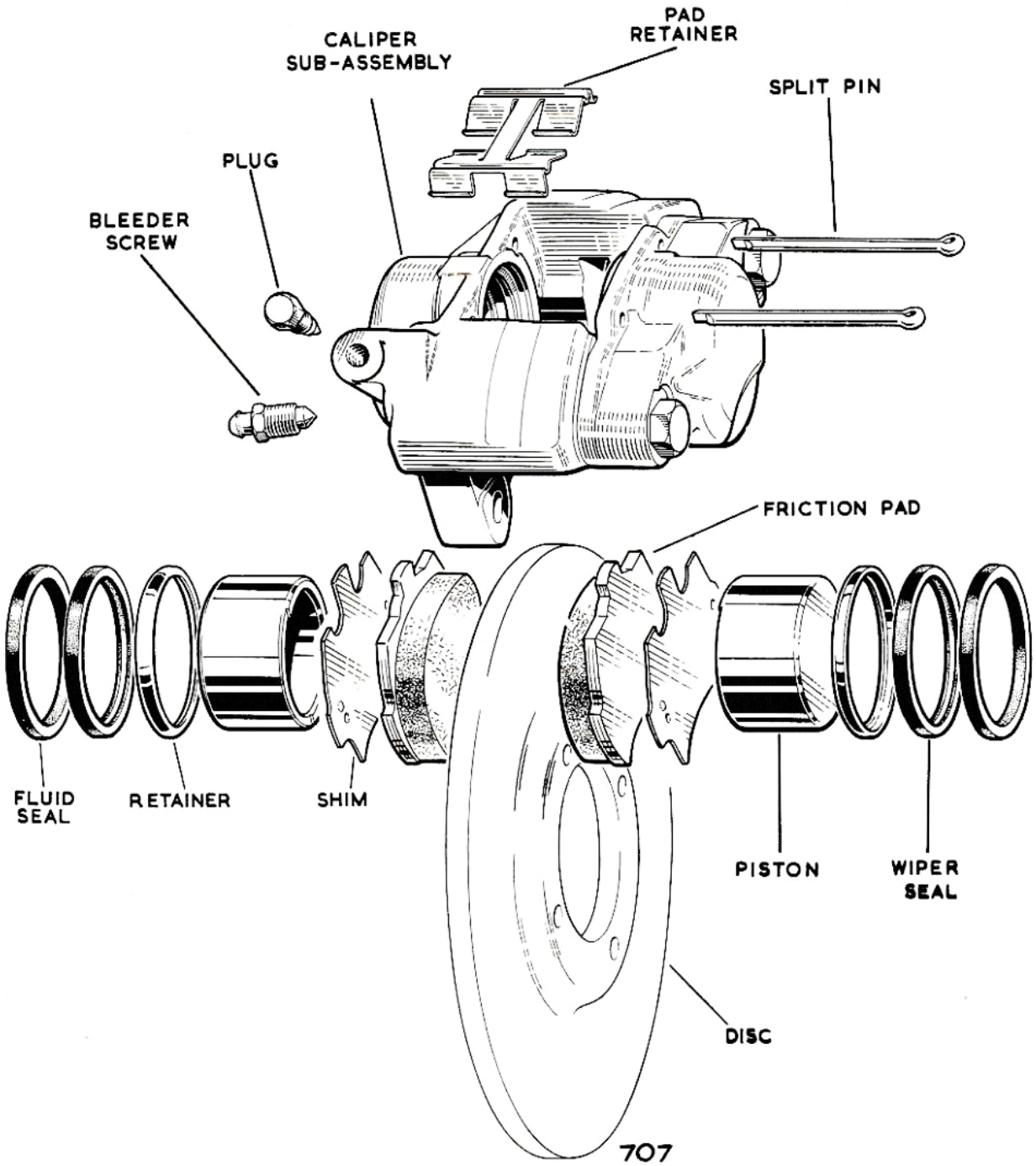
Thoroughly clean the outer surfaces of the caliper, using Ethyl Alcohol as required. If present, note the position of the relieved portion of the piston face relative to the caliper bore. On some models there is no cutaway on the face of the piston. In this case, the position of the piston bearing face is immaterial.

Fit the clamp, without the spacer piece, on the rim half of the caliper to restrain the piston.

Place a receptacle under the caliper unit to receive displaced brake fluid, and gently depress the foot brake pedal to force out the mounting half piston sufficient to extract it by hand (no tool or air line should be used to expel the piston nor should heavy foot pressure be applied to the pedal in an attempt to dislodge a seized piston). The only satisfactory remedy for a seized piston is renewal of the whole caliper assembly.






PAD
RETAINER
CALIPER
SUB-ASSEMBLY
SPLIT PIN
PLUG
BLEEDER
SCREW
FRICTION PAD
FLUID
SEAL
RETAINER
SHIM
PISTON
WIPER
SEAL
DISC
707

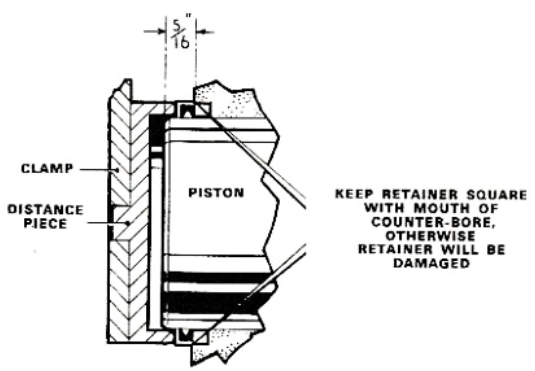
The wiper seal retainer can now be removed by inserting a blunt screwdriver between the retainer and the seal to prise the retainer carefully from the mouth of the bore. Taking great care not to damage the seal grooves in the bore, extract the wiper/dust seal and the fluid seal.

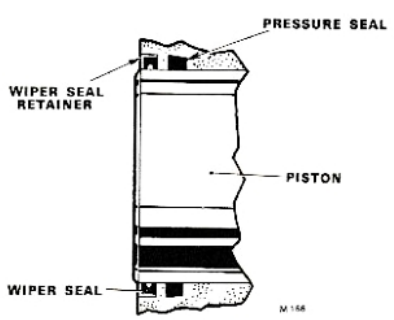
Clean the piston, bore and particularly the seal grooves with **clean brake fluid or Ethyl Alcohol only.** If the caliper bores and pistons are corroded or the condition of them is not perfect, the parts must be renewed.

Coat the new fluid seal with LOCKHEED Disc Brake Lubricant. Ease the seal into the groove in the bore with the fingers, taking care to bed it correctly. The fluid seal groove and the seal are not the same in section, thus when bedded the seal feels proud to the touch at the edge furthest away from the mouth of the bore. This is normal.

Slacken the bleeder screw on the rim half of the caliper one complete turn. After coating the piston with LOCKHEED Disc Brake Lubricant, insert it squarely into the bore with the fingers so that the relieved face occupies its previously noted position. Avoid tilting the piston during insertion to leave $\frac{5}{16}$ in. projecting from the mouth of the bore.

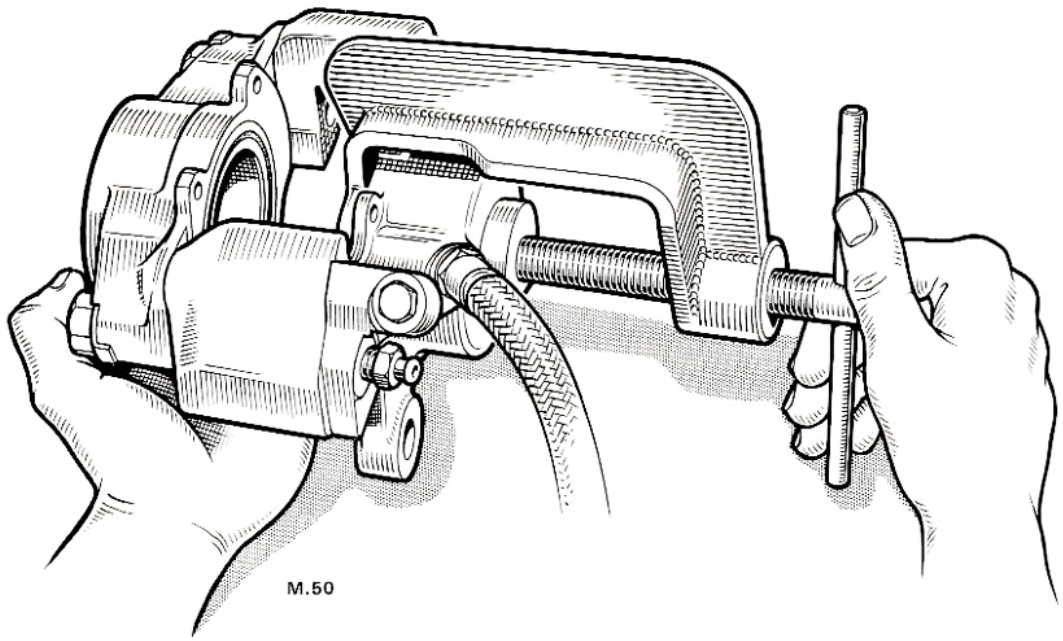
Coat a new wiper seal with LOCKHEED Disc Brake Lubricant and fit it into the seal retainer. Slide the assembly squarely, seal side first, into the mouth of the bore using the piston as a guide. Remove the piston clamp from the rim half and with the help of the distance piece, if applicable, carefully use the clamp to press home the seal, taking special precaution not to distort the retainer. The flexible hose must be disconnected from the caliper on some assemblies to locate the clamp properly on the mounting half.





Without the distance piece, use the clamp to press the piston fully into the bore. Tighten the bleeder screw, and where applicable, move the clamp to permit reconnection of the flexible hose.

Using the clamp just enough to prevent movement of the mounting half piston, depress the foot brake pedal gently to ease out the rim half piston.



M.50

In the sequence described above, deal with the rim half piston, seals and retainer. Ensure that the bleeder screw is slackened when refitting the piston, and then tightened before overhaul of the other caliper of the axle.

Bolt the caliper on to the mounting bracket, tightening the bolts to the torque specified by the vehicle manufacturer.

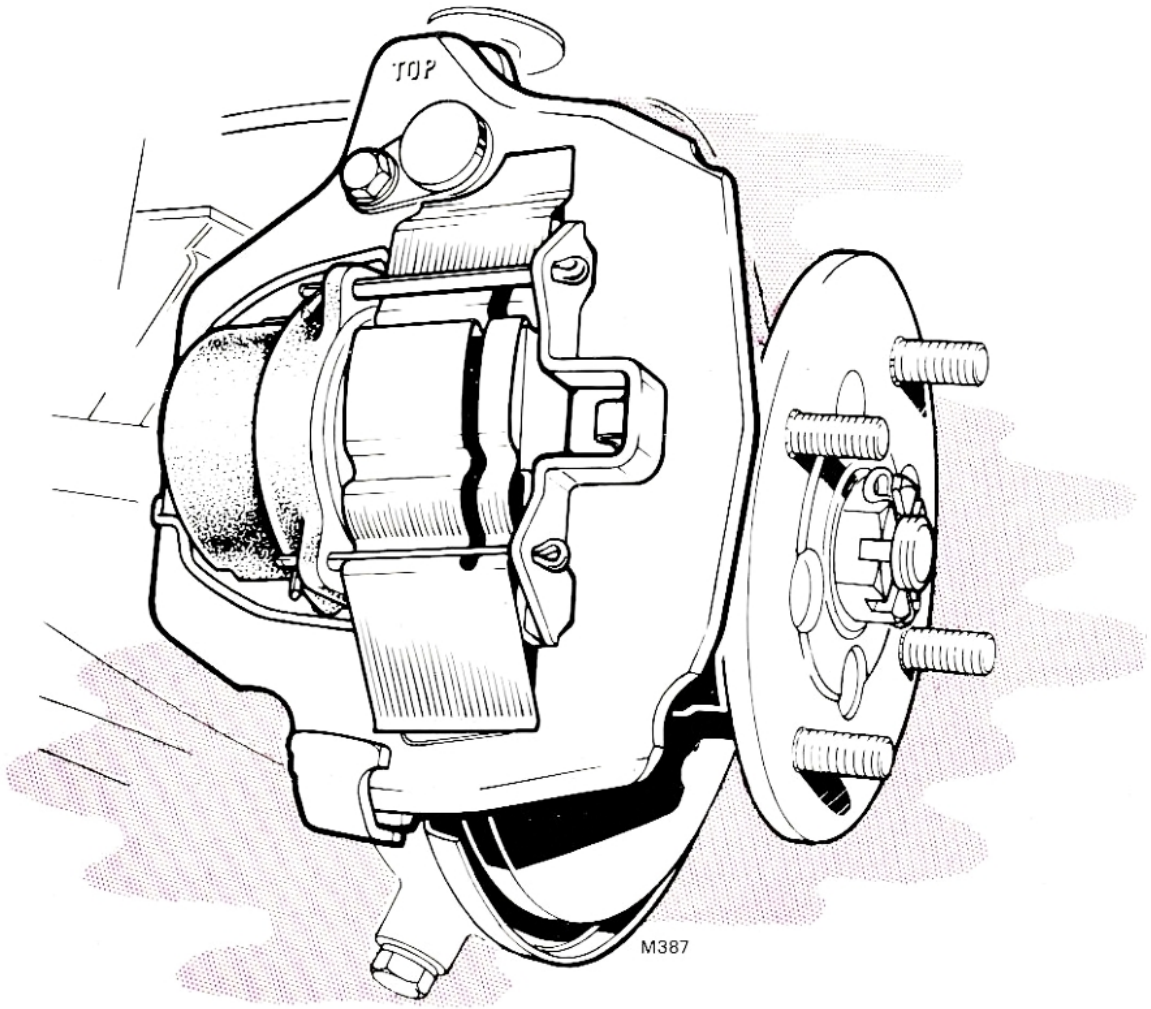
Insert the friction pads, and shims if fitted, into the caliper recesses. Locate the retaining spring or springs where applicable, and replace the split pins.

On completion of the overhaul, bleed the system thoroughly at all brake assemblies as described in Section 11, and replenish with the appropriate LOCKHEED Brake Fluid. Operate the brake pedal firmly several times to adjust the friction pads whilst an assistant inspects the system for leaks. Finally, recheck the fluid level in the master cylinder supply tank, topping up as necessary, before road testing the vehicle.

LOCKHEED

disc brakes-single cylinder caliper

SECTION 2C



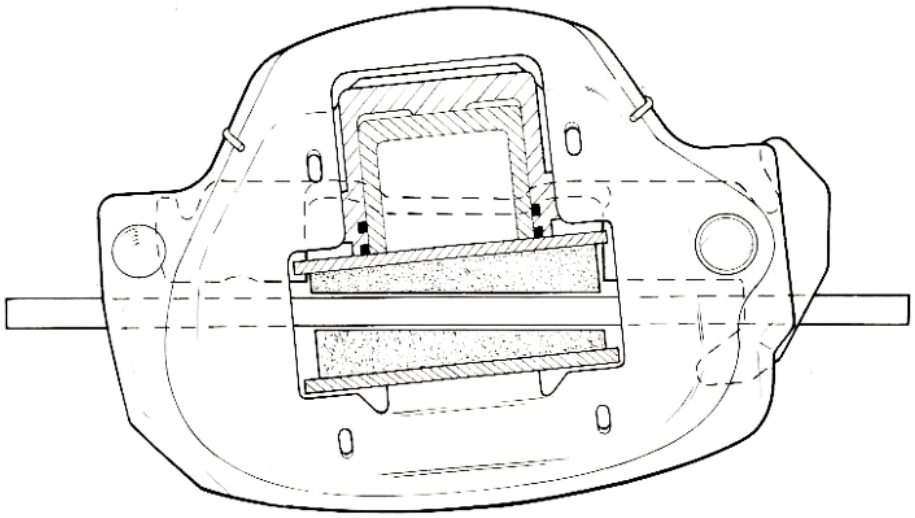
DESCRIPTION

A single cylinder disc brake caliper known as the type SC, has been added to the Lockheed range of calipers. The frame of the assembly is a rigid steel pressing, and a single hydraulic cylinder is secured into one side of the frame by a simple spring clip. The whole caliper unit is allowed to pivot at one end so that when the brake pedal is depressed, moving the hydraulic piston and one pad assembly towards the disc, the unit moves in opposition to achieve equal pressure on the other pad.

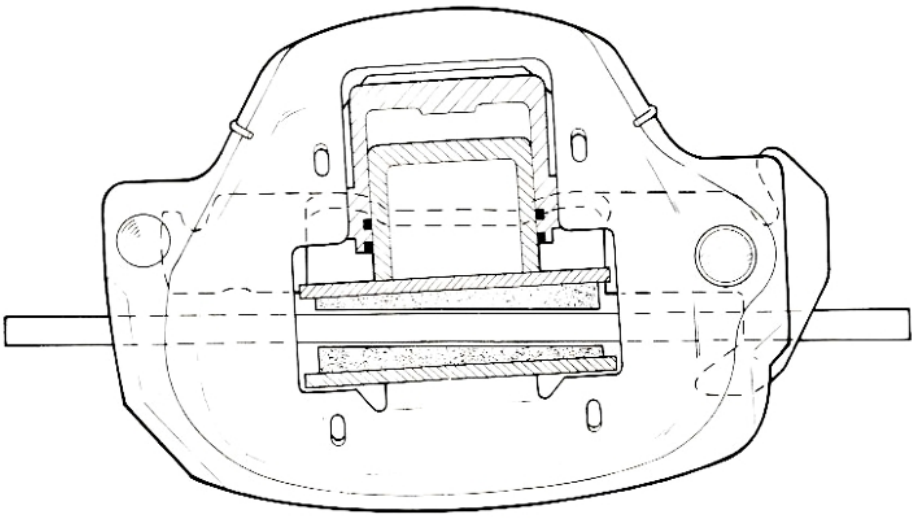
As the pads wear, the caliper will move through an arc about its pivot, and to compensate for this the pad friction material is tapered in section. This angle of taper gradually reduces as wear takes place so that in a fully worn state the remaining material is parallel to the backing plate.

The hydraulic piston is fitted into a fluid seal located in the cylinder body, and movement of the piston causes the seal to deflect in the bore. When the brakes are released the fluid seal moves back to its original position causing the piston to retract. This, and the movement of the caliper body about its pivot creates a running clearance between the pads and the disc.

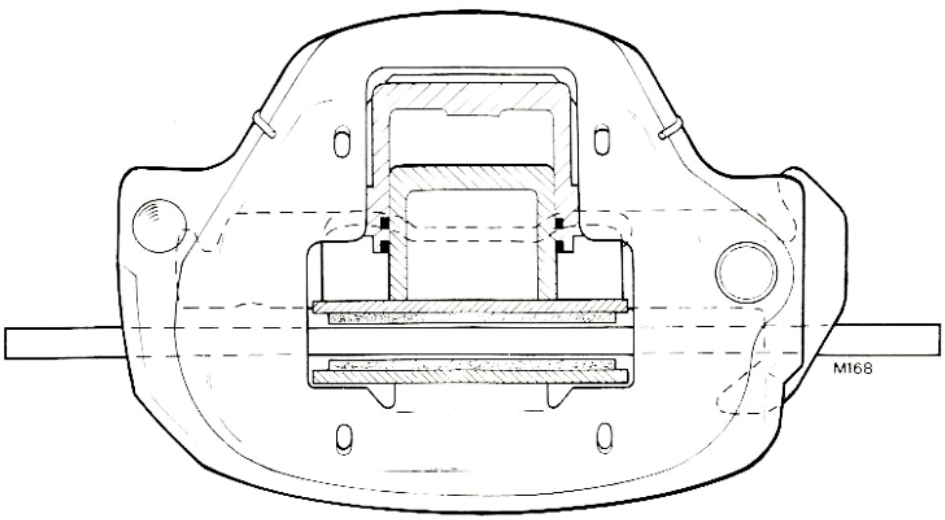
A rubber wiper/dust seal and retainer fitted at the mouth of the cylinder excludes dirt and moisture.



ASSEMBLY WITH NEW PADS



PADS PART WORN



PADS FULLY WORN

renewing the friction pads

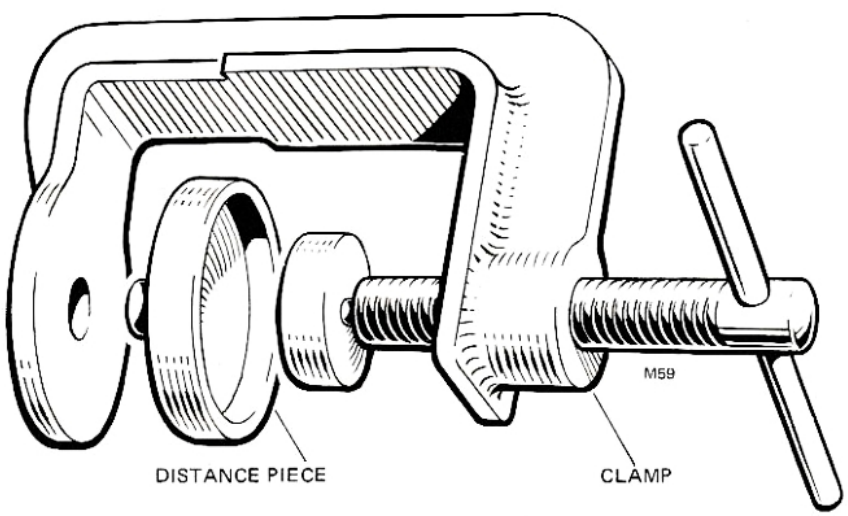
SECTION 2C

Replacement of the friction pads is a simple process, made easier by the use of a piston clamp. This clamp is obtainable through the vehicle distributors or from stockists under Part No. 4171—959.

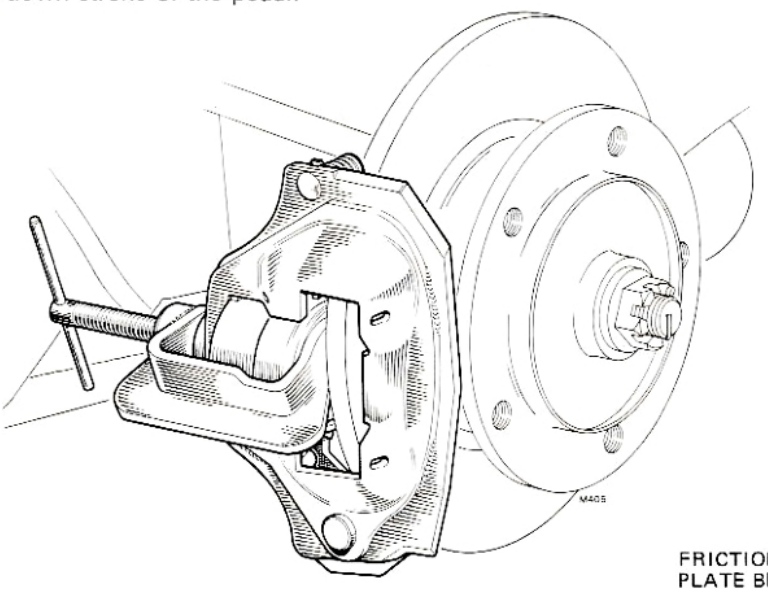
The friction pads are supplied in kit form for the two caliper assemblies of an axle by all Automotive Products Company Limited stockists. **Always renew the pads of both calipers of an axle otherwise unbalanced braking will result.**

Having removed the road wheel withdraw the split pins and remove the pad retainer.

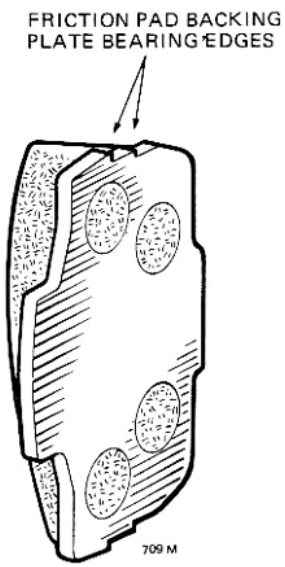
Lift the pads out of the caliper and clean the pad recesses and the exposed part of the piston thoroughly. Only clean brake fluid must be used on the piston.



Provided the surface finish of the piston is undamaged, lightly smear the faces and the pad recesses with LOCKHEED Disc Brake Lubricant, and press the piston back into the cylinder bore using the clamp. During this operation, brake fluid will be displaced into the brake master cylinder supply tank. Care should be taken to prevent overflow by lowering the level of fluid in the supply tank. In practice, this is best done by opening one of the bleeder screws to release excess fluid whilst the foot pedal is being depressed and then retightened at the end of the down stroke of the pedal.

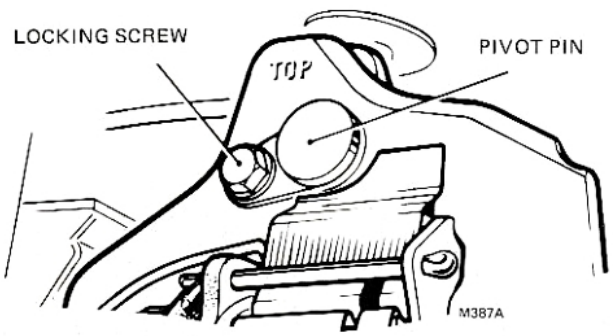


Check the bearing edges of the new friction pads for blemishes. High spots on the steel backing plates may be rectified by carefully dressing with a file. Lightly smear the metal to metal contact edges of the backing plate with LOCKHEED Disc Brake Lubricant, carefully avoiding the friction material.

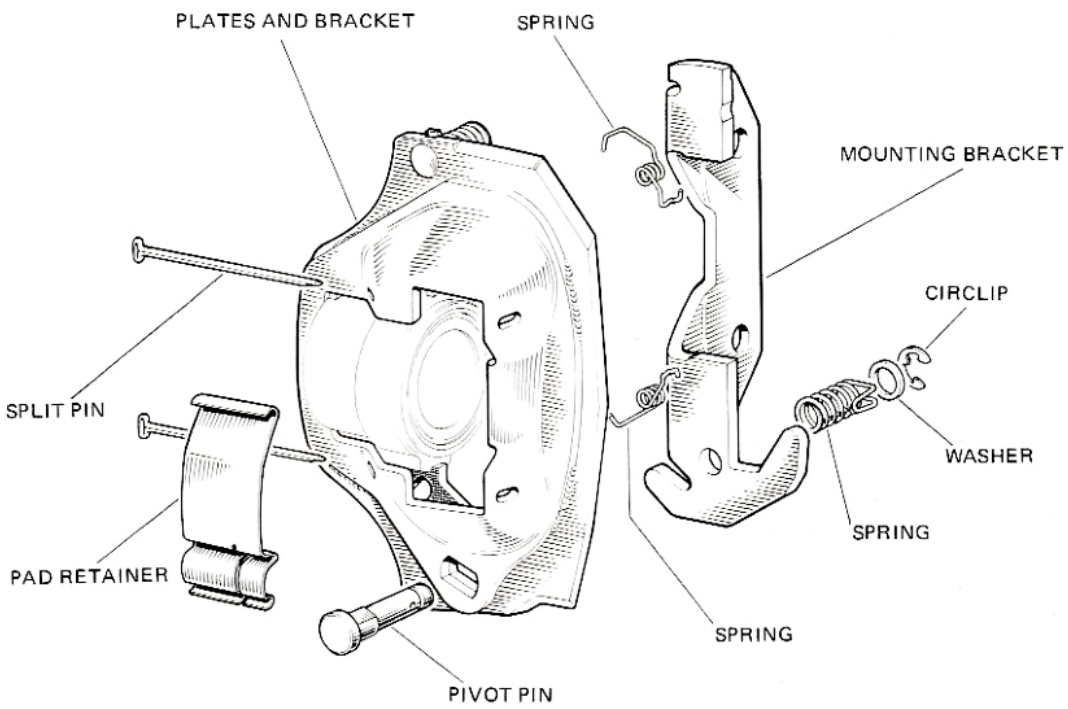


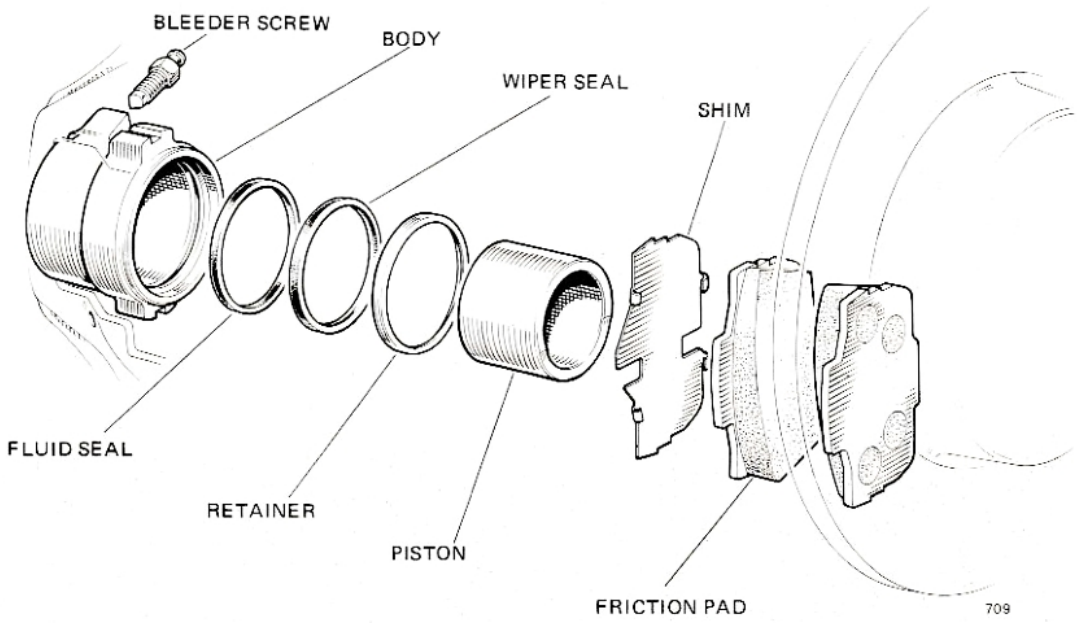
Insert the new pads into the caliper recesses. Replace the pad retainer and fit the split pins.

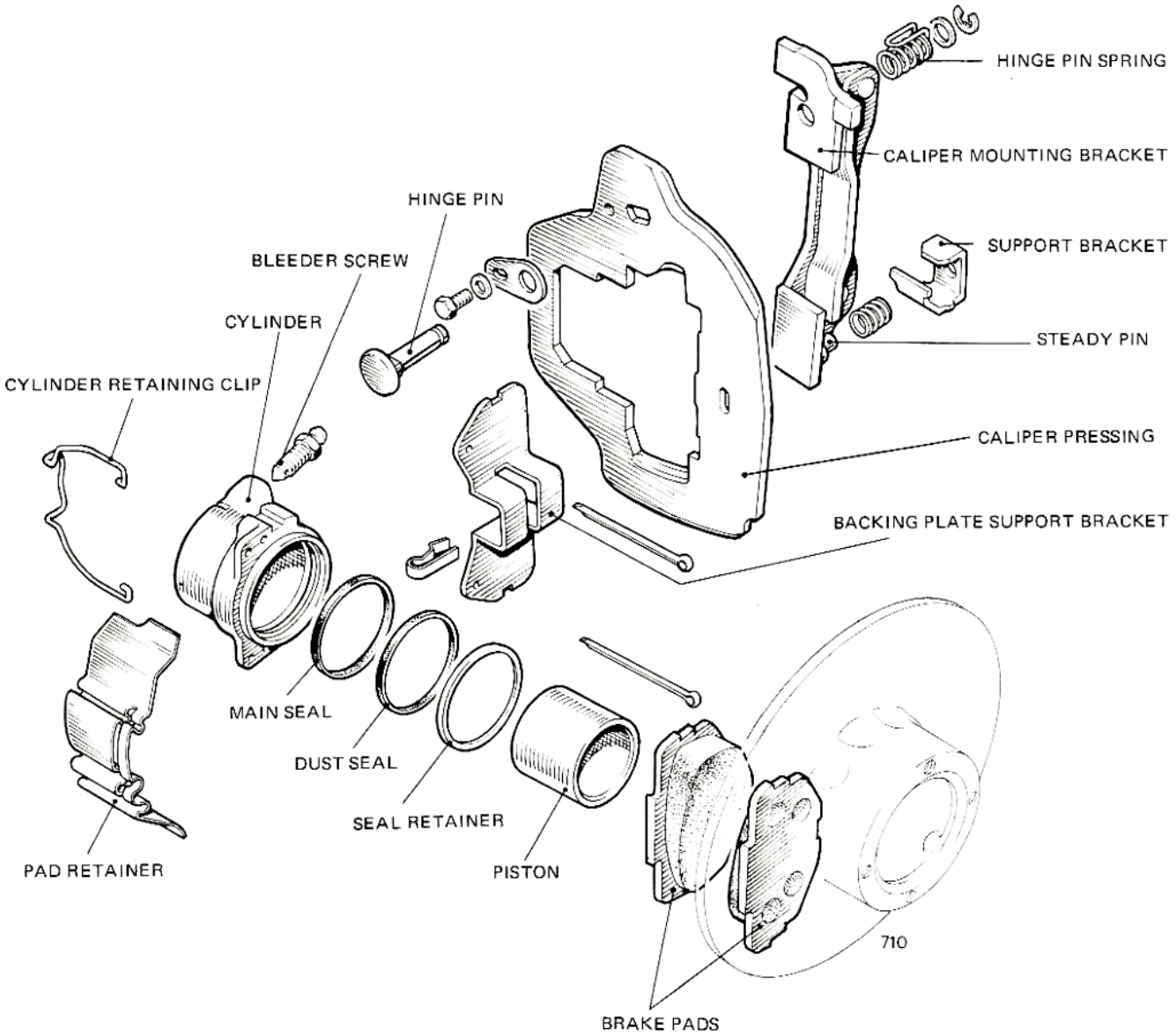
Depress the foot brake pedal several times to locate the friction pads.



On calipers fitted with a locking plate for the pivot pin, loosen the locking screw and apply a light load at the brake pedal sufficient to bring the pads into contact with the disc. Tighten the screw to a torque of 65—80 lbs. ins. This procedure will re-align the pivot pin.


PLATES AND BRACKET
SPRING
MOUNTING BRACKET
CIRCLIP
SPLIT PIN
WASHER
SPRING
PAD RETAINER
SPRING
PIVOT PIN


BLEEDER SCREW
BODY
WIPER SEAL
SHIM
FLUID SEAL
RETAINER
PISTON
FRICTION PAD
709



CALIPER ASSEMBLY WITH
ALTERNATIVE BODY PRESSING

The exchange service operated by the Automotive Products Company Limited, ensures a factory tested and correct replacement which should be fitted whenever possible. A replacement cylinder assembly only may be obtained if necessary, but this should only be fitted if the caliper frame pivot pin etc. are in perfect condition. However, if overhaul of the hydraulic cylinder is undertaken, the procedure detailed below must be followed. Remove the split pins, pad retainer and friction pads. If it is intended to refit the used pads take note of the original positions.

Remove the two retaining bolts and lift the caliper assembly away from the disc. Take care not to stretch the brake hose.

Gently depress the foot brake pedal to force out the piston sufficient to allow it to be extracted by hand at a later stage. Disconnect the hose at its inboard end and plug the exposed ends of the hose and the steel pipe to prevent loss of fluid and ingress of dirt.

Remove the spring clip(s) retaining the cylinder body and withdraw the cylinder assembly from the caliper frame.

Thoroughly clean the caliper frame and mounting bracket with a proprietary cleaner. Should the subsequent inspection reveal wear in the pivot pin or caliper frame it is advisable to fit a new complete assembly.

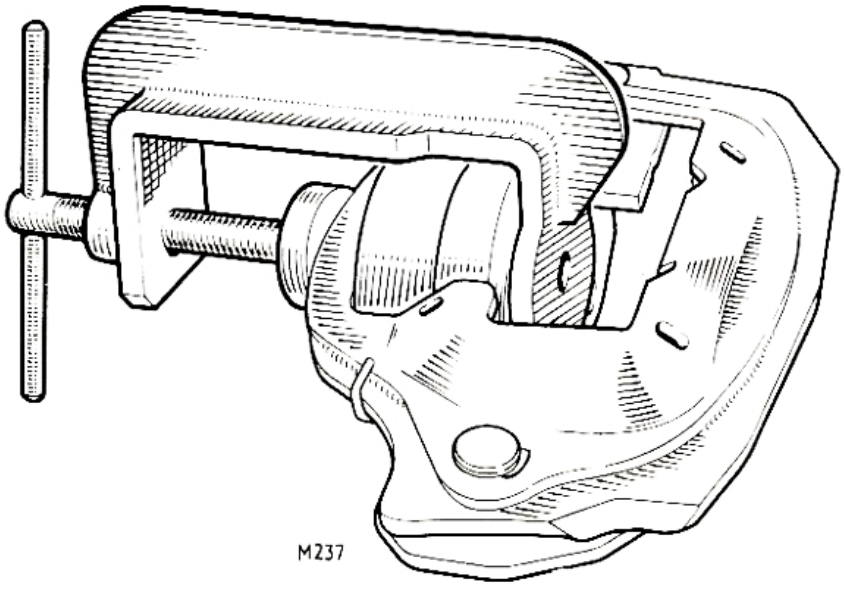
Remove all external dirt from the cylinder assembly using clean brake fluid or Ethyl Alcohol only. Withdraw the piston. The wiper seal retainer can now be removed by inserting a blunt screwdriver between the retainer and the seal to prise the retainer carefully from the mouth of the bore. Taking great care not to damage the seal grooves in the bore, extract the wiper/dust seal and the fluid seal.

Clean the piston, bore and particularly the seal grooves with clean brake fluid or Ethyl Alcohol only. If the caliper bore and piston are corroded or the condition of them is not perfect the parts must be renewed.

Coat the new fluid seal with LOCKHEED Disc Brake Lubricant. Ease the seal into the groove in the bore with the fingers, taking care to bed it correctly. The fluid seal groove and the seal are not the same in section, thus when bedded the seal feels proud to the touch at the edge furthest away from the mouth of the bore. This is normal.

Slacken the bleeder screw one complete turn. After coating the piston with LOCKHEED Disc Brake Lubricant insert it squarely into the bore with the fingers. Avoid tilting the piston during insertion and leave approximately $\frac{5}{16}$" projecting from the mouth of the bore.

Coat a new wiper seal with LOCKHEED Disc Brake Lubricant and fit it into the seal retainer. Slide the assembly squarely, seal side first, into the mouth of the bore using the piston as a guide.



Using the piston clamp, carefully press home the assembly, taking special precaution not to distort the retainer. Tighten the bleeder screw finger tight.

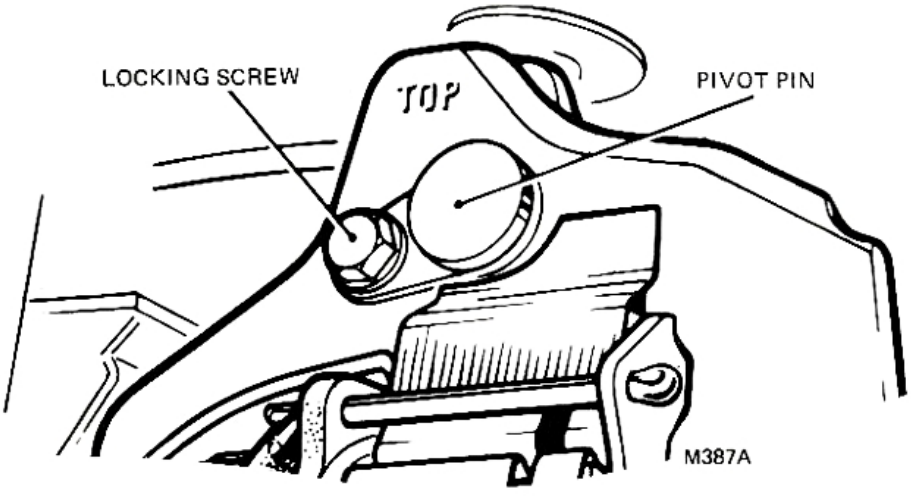
Remount the cylinder assembly into the caliper, taking care that the caliper frame locates into the slots machined in the cylinder body and refit the spring clip(s).

Bolt the caliper assembly back into position, and reconnect the flexible hose, ensuring that the hose is not twisted during this operation.

Replace the friction pads, pad retainer and split pins.

On completion of the overhaul, bleed the system thoroughly at all brake assemblies as described in Section 11 and replenish with the appropriate LOCKHEED Brake Fluid. Depress the brake pedal several times to adjust the friction pads whilst an assistant inspects the system for leaks. On calipers fitted with a locking plate for the pivot pin, loosen the locking screw and apply a light load at the brake pedal sufficient to bring the pads into contact with the disc. Tighten the screw to a torque of 65—80 lbs. ins. This procedure will re-align the pivot pin.

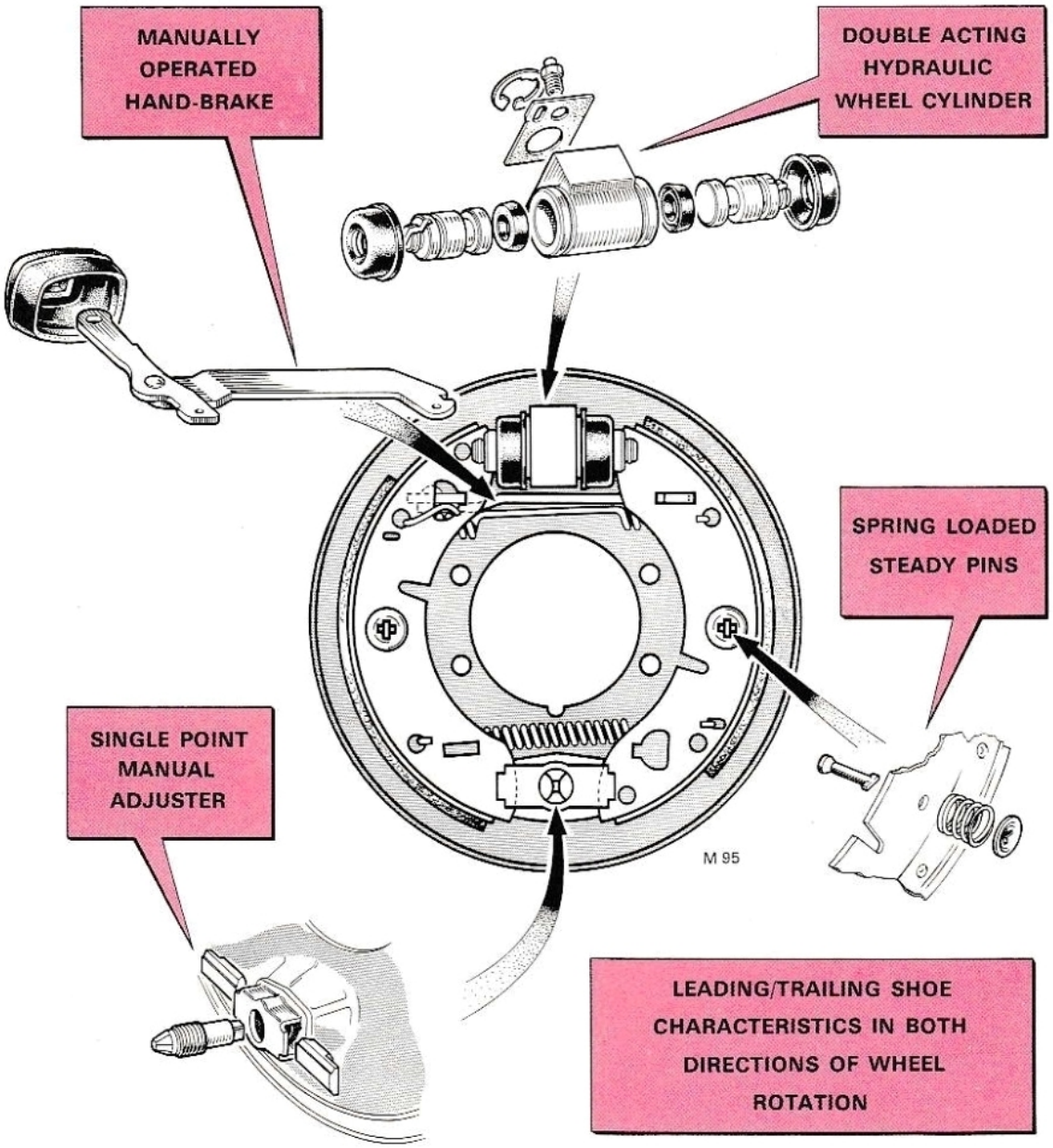
N.B. The locking screw incorporates a nylon pellet in the threads, which if hardened by age or excessive heat will make the locking action non-effective. In this event the locking screw should be replaced. Finally, recheck the fluid level in the master cylinder supply tank, topping up as necessary, before road testing the vehicle.



LOCKHEED

rear drum brakes – light vehicles

SECTION 4A



ROUTINE ADJUSTMENT

Every 3,000 miles or earlier if brake pedal travel is excessive. Refer to the introductory sheet for the make and model of vehicle in Section 1.

ROUTINE MAINTENANCE

Refer to the Servicing Summary and Routine Attention at the end of Section 1. When inspecting the shoe linings for wear every 5,000 miles, check the fit and condition of the rubber boots on the wheel cylinder, and the boot for the handbrake lever. Renew if found defective or where there is doubt. To increase the protection, fill the inside of new wheel cylinder boots with LOCKHEED 'Rubberlube' before fitting.

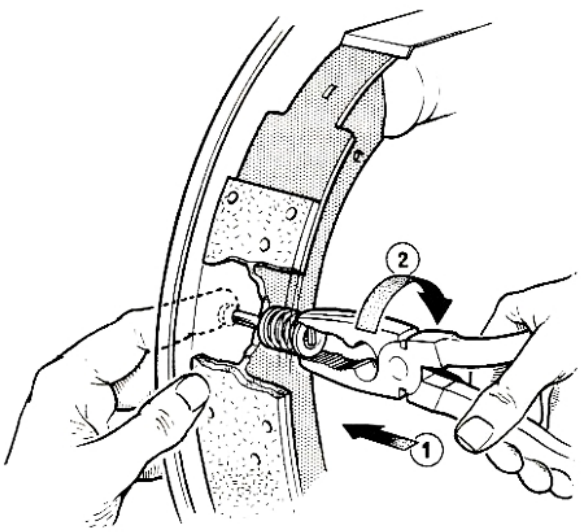
REMOVING THE SHOES

Back-off all brake adjustment by turning the square end of the adjuster spindle anti-clockwise as viewed from the inboard side of the backplate. Remove the road wheel and brake drum.

Withdraw the clevis pin to release the handbrake lever at the brake assembly from the handbrake linkage.

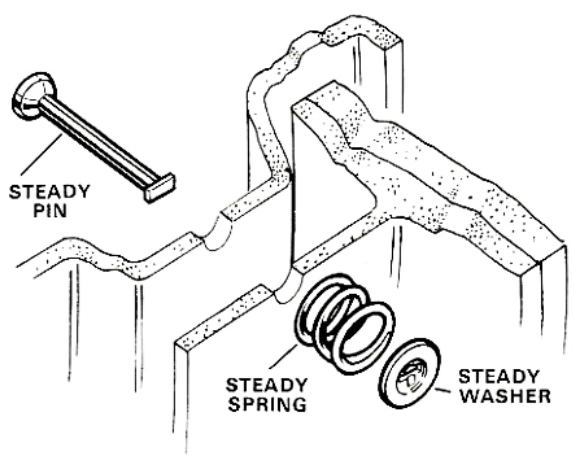
Depress and turn the shoe steady pin washers to release the steady pins and springs (Fig. 1). Extract the steady pins from the inboard side of the back-plate (Fig. 2).

Take note of the positions of the shoes and springs. Remove the handbrake cross lever bias spring where fitted.



M127

Fig. 1



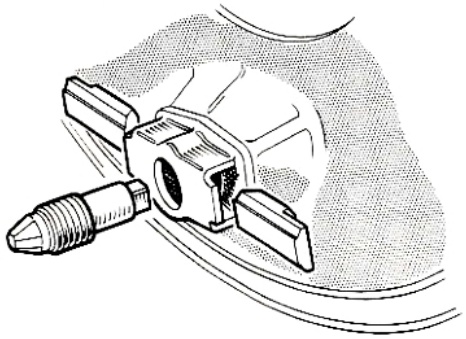
M330

Fig. 2

Pull the end of one of the shoes away from the adjuster tappet against the load of the tension spring. Do not overstretch the spring. Unhook the spring from the webs of both shoes.

Move the shoe engaged by the **smaller** hook of the pull-off spring away from the axle until it is possible to release the end of the handbrake cross lever from the slot in the web of the shoe. Unhook the pull-off spring and remove the shoe. Free the other shoe from the cross lever. Retrieve the pull-off spring.

If no further dismantling is required, prevent ejection of the wheel cylinder pistons by restraining them to the cylinder body with a twist of wire or by a suitable clamp. Take care not to damage the rubber boots.



M 95A

Fig. 3

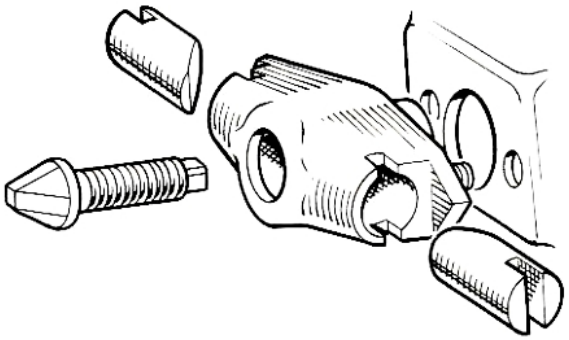
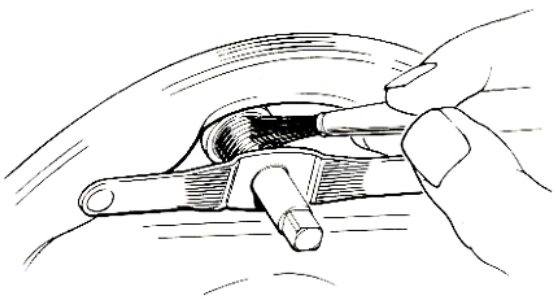


Fig. 4 M 198A

Extract the adjuster tappets and adjuster screw (Fig. 3 or 4). First clean the parts, and then coat them with *PolyButylCuprysil (PBC), SHELL Corrosion Resistant Grease SB.2628 or equivalent. Screw the adjuster fully into place to provide **minimum** adjustment and ensure that the threads exposed beyond the backplate are well coated with the grease. A small brush will be found useful for the purpose (Fig. 5). Insert the tappets so that the chamfered inner ends coincide with the taper angle of the adjuster screw.

* PolybutylCuprysil is an anti-seize lubricant and protective. Manufactured by K. S. Paul Products Ltd., Nobel Road, London N.18.



M 256

Fig. 5

REPLACING THE SHOES

Examination

Discard the old springs if they appear weak or overstretched. If doubtful, compare with new spring.

The shoes should be renewed if the linings have worn to less than one-third of original thickness. Renewal is also necessary if the linings are contaminated with lubricants or hydraulic fluid irrespective of the state of wear. The exchange shoe scheme operated by the Automotive Products Company Limited, is the only way of obtaining replacement LOCKHEED shoes to the correct specification. To ensure balanced performance, it is necessary to replace the shoes on **both** brake assemblies of an axle.

Remove all dust and deposits from the original parts and from the friction surface of the drum using Ethyl Alcohol (Industrial Methylated Spirit) only as a solvent where found necessary. Dry thoroughly. Except for rubber parts, other recognised cleaning agents may be used.

Examine the condition of the rubber boots on the wheel cylinder. Renew if defective. Check for signs of fluid leaks and rectify accordingly.

Sequence

Other than hydraulic parts, metal to metal contact points, particularly the pivot on the handbrake cross lever, should be lubricated **lightly** with the grease in the sachet provided with the replacement shoe kit or with a good quality high melting point grease. **AVOID CONTACT OF GREASE WITH THE SHOE LININGS, RUBBER PARTS AND THE FRICTION SURFACE OF THE DRUM.**

Install the shoes and refit the drum by reversing the procedure described above for removal. Ensure that the handbrake linkage is reconnected. Turn the adjuster until the drum cannot be turned by hand. Back-off the adjustment to allow the drum to be revolved freely through 360°.

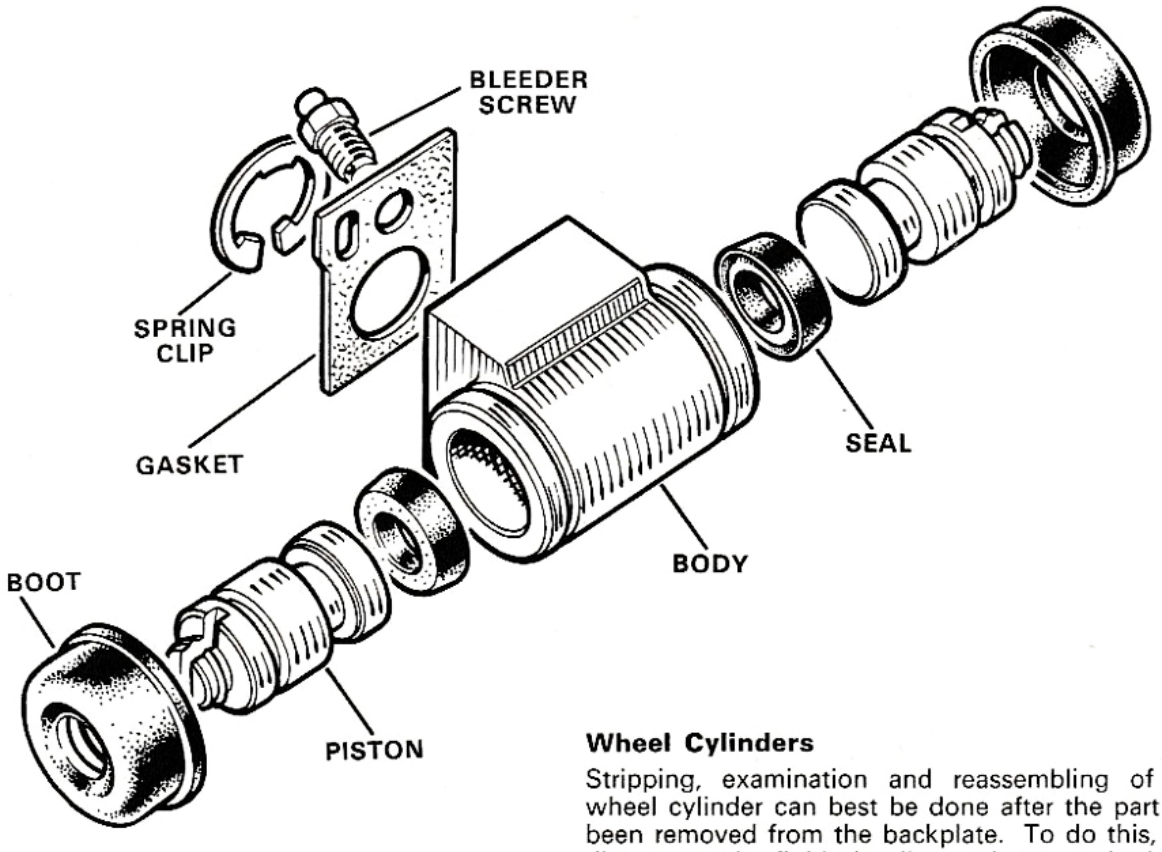
Fit the road wheel. Operate the brake pedal hard several times to centralise the brake shoes. Recheck for correct adjustment and also for effectiveness of the handbrake.

Repeat the sequence for the other brake assembly of the axle. Road-test the vehicle when all work on the braking system has been completed.

The exchange service operated by the Automotive Products Company Limited, ensures a factory tested and correct replacement which should be fitted whenever possible. However if overhaul is undertaken, the procedure detailed below must be followed.

DISMANTLING

Remove the brake shoes as described under 'Brake Shoe Replacement' before dealing with the wheel cylinders.



M 331

Wheel Cylinders

Stripping, examination and reassembling of the wheel cylinder can best be done after the part has been removed from the backplate. To do this, first disconnect the fluid pipe line and extract the bleed screw. Plug the pipe and the openings in the body to prevent loss of fluid and entry of dirt. From the inboard side of the backplate, prise off the spring clip to release the cylinder assembly and gasket, where fitted. Disengage the rubber boots from the cylinder body and pistons. Push the pistons out of the bore. Remove the rubber seal from each piston, taking care not to burr the metal, especially the seal groove.

Extract the adjuster tappets and adjuster screw. Unless damaged, there is no need to remove the detachable type of adjuster body. Damage of the alternative type of adjuster body, which is a fixture on the backplate, will require replacement of the whole backplate assembly.

REASSEMBLING

Examination

Carefully inspect all components for faults and wear. **A replacement wheel cylinder assembly will always be required where the bore of the old cylinder, after cleaning, shows the slightest signs of corrosion or scoring.**

If the metal parts of the original wheel cylinder are found to be in perfect condition, be prepared to fit new rubber parts. These are available in repair kit form.

A new spring clip, and gasket (where applicable) will be required to fit the wheel cylinder body to the backplate.

Discard the old springs if they appear weak or overstretched. If doubtful, compare with new springs.

The shoes should be renewed if the linings have worn to less than one-third of original thickness. Renewal is also necessary if the linings are contaminated with lubricants or hydraulic fluid irrespective of the state of wear. The exchange shoe scheme operated by the Automotive Products Company Limited, is the only way of obtaining replacement LOCKHEED shoes to the correct specification. To ensure balanced performance, it is necessary to replace the shoes on **both** brake assemblies of an axle.

Hydraulic parts should be washed in clean LOCKHEED brake fluid. A recognised cleaning agent may be used as a solvent for cleaning other components, including the friction surface of the brake drum, afterwards taking care to dry the parts thoroughly.

Inspect the brake drum. Renew if found to be unduly worn, scored or otherwise defective.

Sequance

LOCKHEED 'Rubberlube' will be needed to increase the protection provided by the rubber boots for the wheel cylinder.

Coat the adjuster tappets and adjuster screw with *PolyButylCuprysil (PBC), SHELL Corrosion Resistant Grease SB.2628 or equivalent. Screw the adjuster fully into place to provide **minimum** adjustment and ensure that the threads exposed beyond the backplate are well coated with the grease. A small brush will be found useful for the purpose. Insert the tappets so that the chamfered inner ends coincide with the angle of taper on the adjuster screw.

Other than hydraulic parts, metal to metal contact points, particularly the pivot on the handbrake cross lever, should be lubricated **lightly** with the grease in the sachet provided with the replacement shoe kit or with a good quality high melting point grease. **AVOID CONTACT OF THE GREASES WITH THE SHOE LININGS, RUBBER PARTS AND THE FRICTION SURFACES OF THE DRUM.**

Make sure the hands are free of grease and dirt. Use clean LOCKHEED brake fluid as a lubricant for the wheel cylinder bore, pistons and rubber seals.

* PolyButylCuprysil is an anti-seize lubricant and protective. Manufactured by K. S. Paul Products Ltd., Nobel Road, London N.18.

Using the fingers only, carefully bed a new seal on one of the wheel cylinder pistons, lip facing away from the slotted head of the piston (Fig. 6). Fit the smaller diameter rim of the rubber boot in the remaining groove on the piston. Repeat the procedure for the other piston.

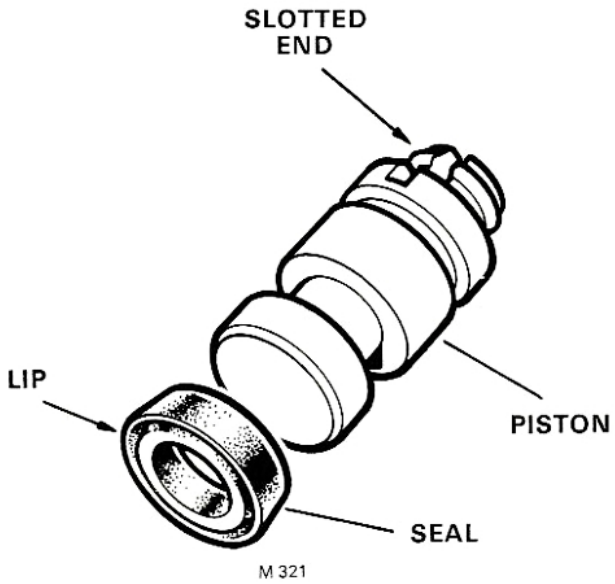


Fig. 6

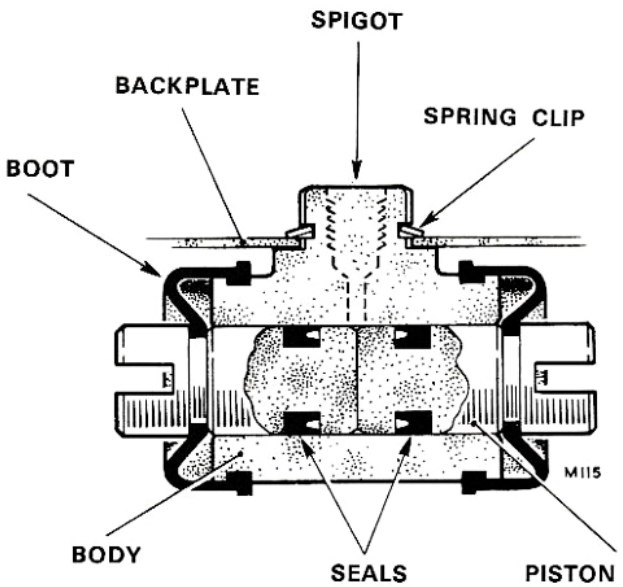


Fig. 7

Push the pistons into the cylinder bore, taking care not to bend back the lips of the piston seals (Fig. 7). Fill each boot with 'Rubberlube' and bed the beaded edge in the respective groove on the cylinder body.

If the cylinder has been removed from the backplate for overhaul, first place a new gasket, where applicable, on the mounting face of the body. Insert the spigot of the body through the hole in the backplate and secure the cylinder with a new spring clip on the inboard side. Fit the bleed screw finger tight.

Install the shoes by reversing the removal procedure.

Refit the brake drum. Ensure that the handbrake linkage is reconnected. Turn the adjuster until the drum cannot be turned by hand. Back-off the adjustment to allow the drum to be revolved freely through 360 .

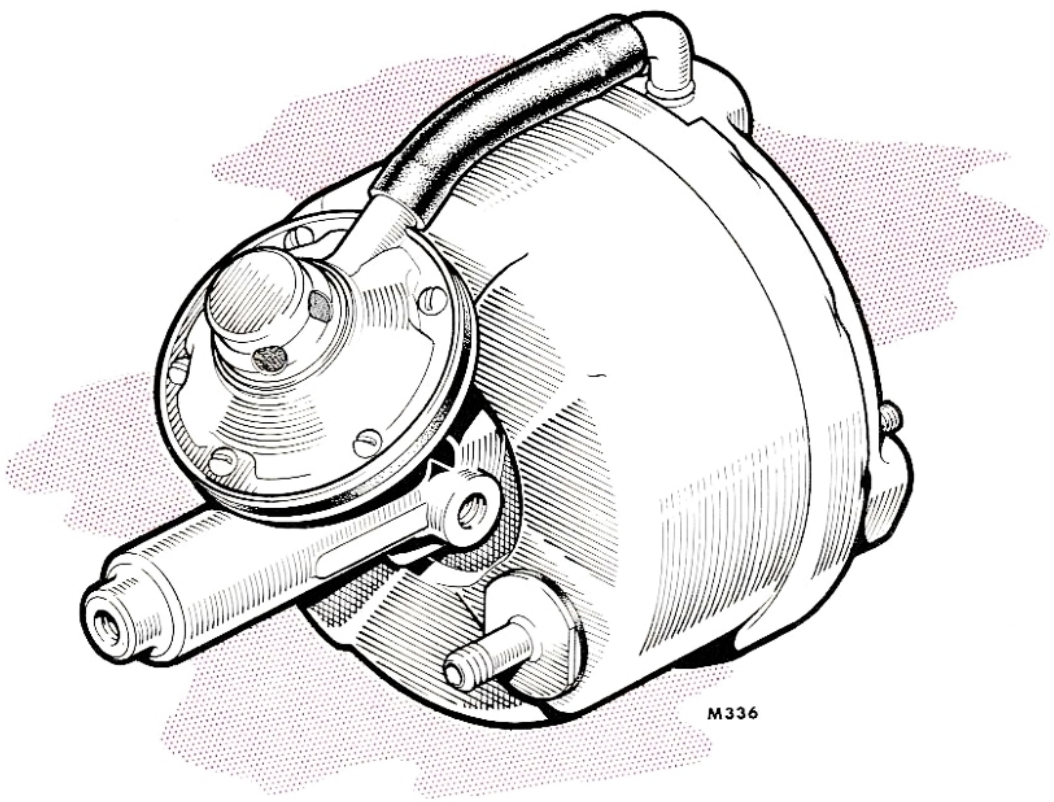
Reconnect the fluid pipe to the wheel cylinder and fit the road wheel. When all other work has been completed on the braking system, bleed thoroughly as detailed in Section 11. Operate the brake pedal hard several times to centralise the brake shoes. Recheck for correct adjustment and also for effectiveness of the handbrake.

Inspect for fluid leaks with the system at rest and also with the foot pedal fully depressed. Ensure that the supply tank for the brake master cylinder has the correct level of fluid before road-testing the vehicle.

LOCKHEED

type 6 and 7 vacuum servo unit

SECTION 5C

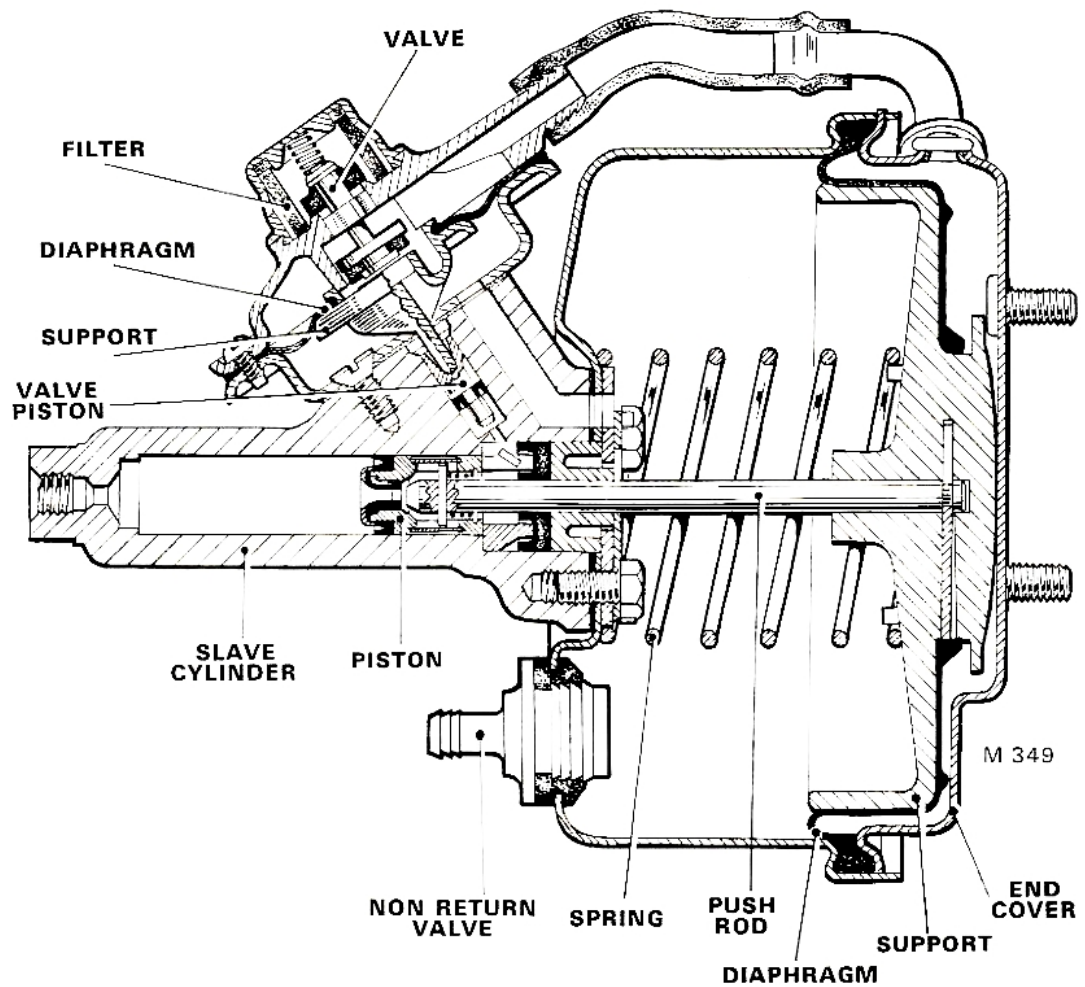


DESCRIPTION

The vacuum servo unit is incorporated in the hydraulic braking system as an intermediate stage between the brake master cylinder and the brake assemblies.

The two main parts of the servo unit are the vacuum servo mechanism and a hydraulic slave cylinder assembly. These are bolted together so that the slave cylinder piston is in line with, and is operated directly by, the servo push rod. Pressure of fluid from the brake master cylinder generated by the action of the foot pedal governs the movement of the servo push rod. Servo assistance is gained from the loading on the push rod by a plastic body of piston shape which supports a rubber rolling type diaphragm forming two chambers in the servo unit's pressed steel shell. In the 'brakes off' position, the plastic support and diaphragm are held by a spring against the end cover of the servo unit in a state of suspended vacuum created by exhaustion of air through a non-return valve and hose connected to the engine's induction manifold. The servo unit is designed to give no assistance with very light brake application. Heavier pedal movement permits the controlled entry of air at atmospheric pressure to the rear chamber causing the diaphragm support to move the servo push rod. The rod presses the slave cylinder piston down its bore to boost the fluid pressure for actuation of the brakes with a force much greater in proportion to the effort exerted by the driver on the foot pedal.

In the absence of servo assistance due to loss of vacuum, an unrestricted passage for the fluid will exist. The brakes can still be applied, therefore, by the normal action of the pedal on the brake master cylinder, but this obviously would demand heavier foot pressure to achieve the same degree of braking as with servo assistance.


VALVE
FILTER
DIAPHRAGM
SUPPORT
VALVE PISTON
SLAVE CYLINDER
PISTON
NON RETURN VALVE
SPRING
PUSH ROD
DIAPHRAGM
SUPPORT
END COVER
M 349

OPERATION

The schematic illustrations opposite show the action of the servo in five selected stages:

A. Servo unit in the 'brakes off' position.

B. Light brake pedal application.

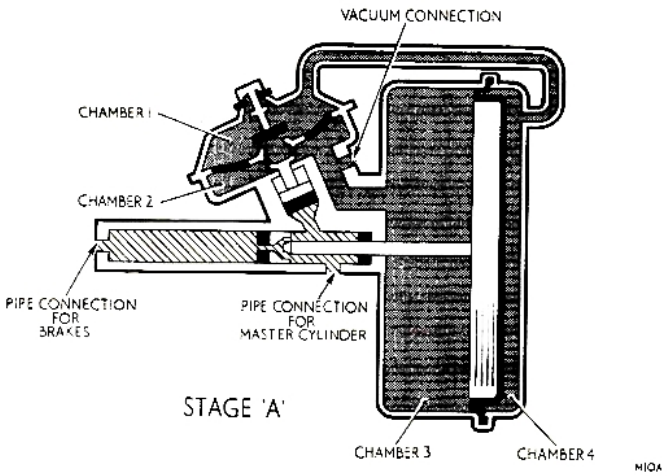
C. Brake pedal applied sufficiently to gain some servo assistance.

D. Brake pedal pressure held steady. Action of the servo unit suspended to retain desired amount of braking effect.

E. Sustained maximum servo assistance following full and rapid foot pressure on the brake pedal.

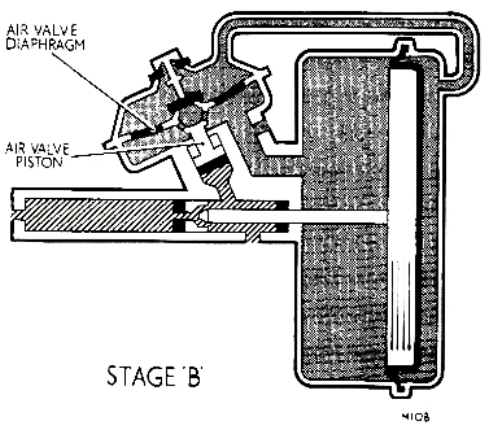
STAGE 'A'

In stage 'A', the servo is at rest. The diaphragm and support are held close to the end cover of the shell by the action of the return spring. With the engine running to provide the source through a non-return valve, the same degree of vacuum exists in chambers 1, 2, 3 and 4 owing to the open inter-connecting passages. Atmospheric air pressure, aided by a small spring, keeps the air valve closed on its seat.



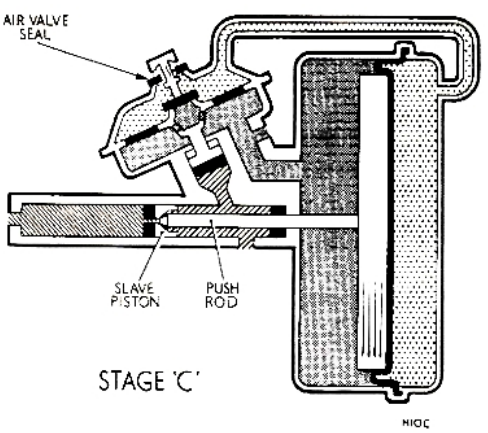
STAGE 'B'

Very light application of brakes only slightly alters stage 'A' situation since the fluid under pressure created by the brake master cylinder passes un-hindered through the hollow centre of the slave piston to the wheel cylinders, but without servo assistance. However, the fluid pressure is sufficient to move the air valve piston which partially deflects the air valve diaphragm, isolating the vacuum source from chambers 1 and 4 in preparation for servo assistance. Stage 'B' refers.



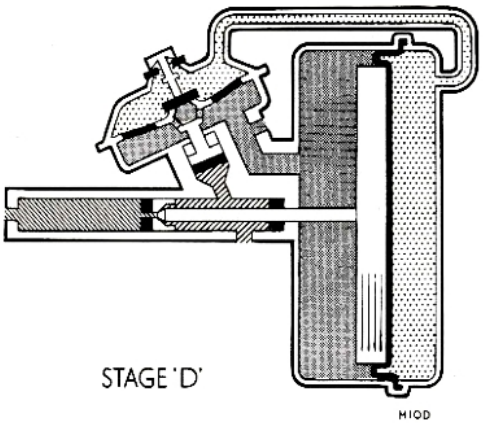
STAGE 'C'

If the pressure on the foot pedal is increased and then held steady, stage 'C' becomes relevant. The greater fluid pressure from the master cylinder moves the air valve piston to further deflect the air valve diaphragm. Simultaneously, the air valve diaphragm support lifts the air valve plunger and allows atmospheric air to enter chambers 1 and 4 past the restriction of the stem supporting the rubber seal of the air valve. The pressure differential thus created in the servo shell between chambers 3 and 4 causes the servo diaphragm to roll on its support towards the slave cylinder, thereby imparting a load on the servo push rod. The initial travel of the servo push rod seals the hollow centre of the slave piston, then moves the piston down the slave cylinder bore to increase the fluid pressure to the wheel cylinders much greater in proportion to the pressure generated by the brake master cylinder.



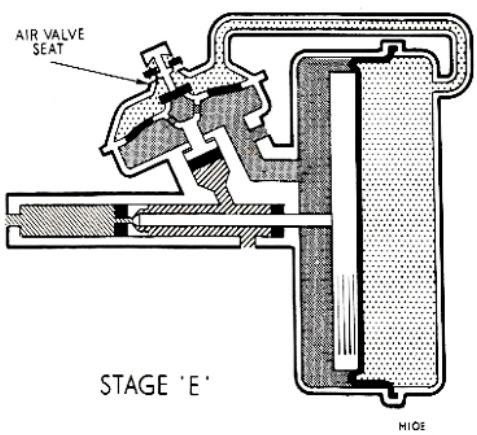
STAGE 'D'

If the loading on the foot pedal is not further increased, the pressure of fluid behind the slave piston instantly starts to diminish as the slave piston moves into the cylinder bore. When the fluid pressure reduces to the point at which the pressure of atmospheric air on the air valve diaphragm overcomes the lift of the air valve piston, a state of balance will occur. The valve piston retracts along its bore, allowing the air valve diaphragm to flex in the same direction. This movement in turn causes the air valve to close, thus cutting off further entry of atmospheric air to chambers 1 and 4 but with the vacuum still maintained in chambers 2 and 3. The brakes are then partially held on as shown in stage 'D'.



STAGE 'E'

Stage 'E' shows the action of the servo to give maximum assistance having passed instantaneously through stages 'B' and 'C'. On rapid and full application of the foot brake pedal as for an emergency stop, the correspondingly higher fluid pressure built up in the slave cylinder, moves the air valve piston to the limit of full deflection of the air valve diaphragm. The entry of air past the air valve, now unseated, is then unimpeded to chambers 1 and 4. Since the pressure differential between chambers 3 and 4 is thereby increased to, and sustained at, the designed maximum, full and unrestricted servo assistance is provided. Similar unseating of the air valve also occurs initially when the pedal is 'stabbed' quickly, yet not to full travel, for rapid response of the brakes. However, unless heavy loading is subsequently applied on the foot pedal, only partial braking commensurate with the held pedal position would then ensue, the servo unit having reverted to stage 'D' as soon as the rapid surge in fluid pressure in the rear compartment of the slave cylinder is reduced by movement of the slave piston.



The servo returns to the 'at rest' position when the foot pedal is released completely to destroy the fluid pressure in the rear compartment of the slave cylinder. The air valve piston retreats fully down its bore by the loading of atmospheric air pressure on the air valve diaphragm, in turn allowing the air valve to close and to seal the servo unit against further entry of air. The deflection of the air valve diaphragm re-opens the vacuum passage to chambers 1 and 3, destroys the pressure differential, and allows the servo diaphragm and support to be forced back to the end cover aided by the action of the main return spring. Consequently, the push rod and attached slave piston withdraw along the slave cylinder bore to accommodate the fluid displaced from the wheel cylinders which rapidly loses its pressure. Displacement of fluid beyond the capacity of the slave cylinder is compensated by the residual movement of the servo push rod which uncovers the hollow centre of the slave piston to provide a through passage for the excess fluid on return to the brake master cylinder.

The exchange service operated by the Automotive Products Company Limited ensures a factory-tested and correct replacement. However, if it is decided to overhaul the assembly, the procedure detailed below must be followed.

DISMANTLING

Before the servo is removed from the vehicle, clean the unit thoroughly and particularly at pipe connections, using ethyl alcohol (commercial methylated spirit) as a solvent.

Plug the hydraulic pipes after separating the connections to the servo slave cylinder to prevent loss of fluid and entry of dirt.

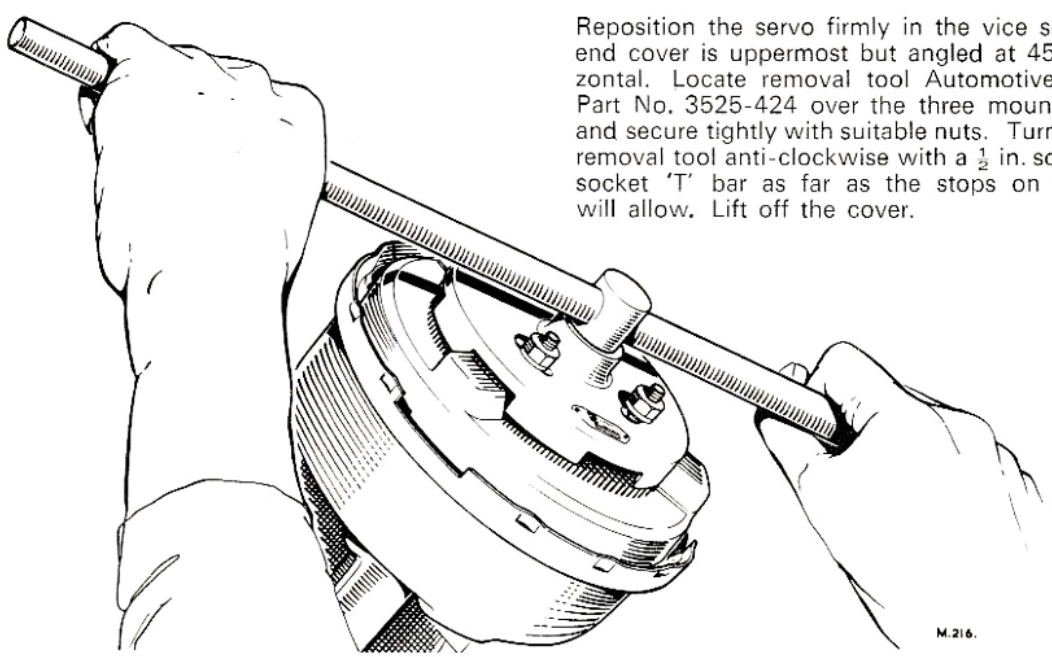
Grip the slave cylinder firmly in a soft jawed vice with the air valve uppermost. Disconnect the rubber pipe from the elbow on the end cover.

Extract the five self-tapping screws holding the plastic air valve cover to the valve housing, and remove the cover complete with air valve sub-assembly. Except to gain access to the filter by taking off the snap fitting dome, the air valve should not be further dismantled. Suspect functioning of the air valve must be remedied by fitting a new component comprising cover, filter and air valve available as an assembled part of the relevant repair kit.

Remove the rubber diaphragm and plastic support to expose the three screws securing the valve housing to the mounting flange on the slave cylinder. Extract the screws and take off the housing followed by the gasket.

With a finger, seal off one of the fluid ports of the slave cylinder and apply a **low** pressure air line to the remaining port to expel the air control valve piston from its bore. Remove the rubber cup from the valve piston.

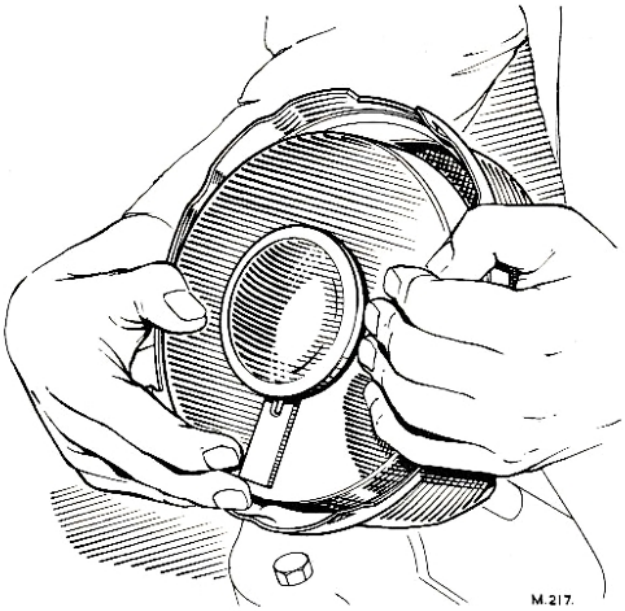
Prise out the vacuum non-return valve from the servo shell using thumb pressure. Extract the rubber valve mounting.



Reposition the servo firmly in the vice so that the end cover is uppermost but angled at 45° to horizontal. Locate removal tool Automotive Products Part No. 3525-424 over the three mounting studs and secure tightly with suitable nuts. Turn the cover removal tool anti-clockwise with a $\frac{1}{2}$ in. square drive socket 'T' bar as far as the stops on the cover will allow. Lift off the cover.

Free the edge of the rubber servo diaphragm from the rim of the servo shell. With the fingers only, ease the centre of the diaphragm out of the groove in the plastic diaphragm support.

Turn the diaphragm support so that the slot for the push rod retaining key faces downwards. Light fluctuating pressure on the support into the shell will release the key and permit the support to lift clear of the push rod under the influence of the main return spring. Extract the spring from the servo shell.



Bend back the tabs of the exposed locking plate. Remove the three bolts used for mounting the slave cylinder, and extract the locking plate followed by the abutment plate. Lift off the servo shell and retrieve the gasket from the mounting face of the slave cylinder.

Withdraw the servo push rod and attached piston assembly from the slave cylinder bore by pulling gently on the rod. Slide off the plastic bearing, rubber cup and plastic spacer noting their relative positions for subsequent refitting.

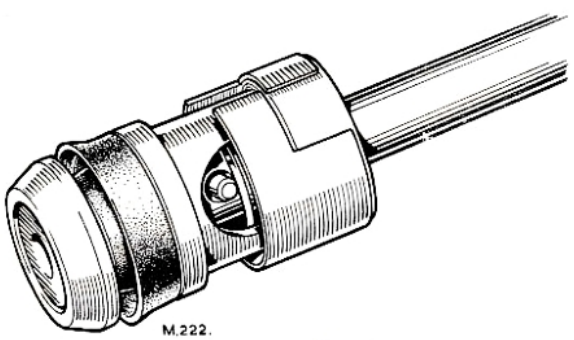


Fig. 1

With the fingers, prise off the rubber seal from the head of the slave piston. The push rod can be separated from the piston by opening the retaining clip with a small screwdriver to expose and then to drive out the connecting pin (Fig. 1). If this is done, a new retaining clip and pin are necessary for reassembling.

REASSEMBLING

Examination

Carefully inspect all parts for faults and wear. Be prepared to fit new rubber parts throughout. These and the slave piston, retaining clip, pin and gaskets are available in repair kit form.

Light dust deposits on the air filter, which is otherwise found to be in good condition, can be removed by blowing through with a **low** pressure air line. Do not use a cleaning fluid or lubricant of any description on the filter.

A separate repair kit for the air control valve contains a complete sub-assembly of cover, filter and air valve. The rubber air valve diaphragm is the other item included in this special kit.

Before reassembling the servo unit, wash all other original parts in clean brake fluid. Wipe dry with a lint free cloth.

Light deposits on the surface of the slave cylinder bore may be removed with clean brake fluid. If blemishes or scoring are apparent after this gentle treatment, a new slave cylinder will be required.

Sequence

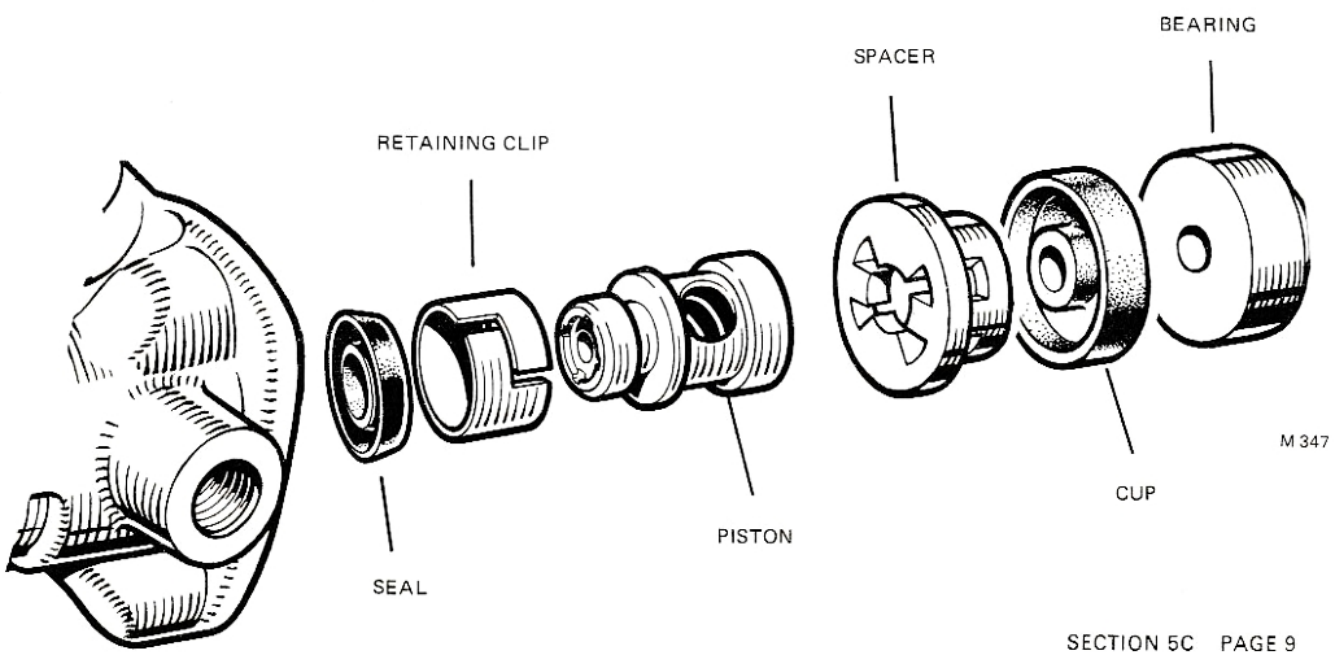
Scrupulous cleanliness of all parts of the servo unit is essential. Make sure the hands are free of grease and dirt. Lay out the parts to be assembled on a sheet of clean paper spread over the work bench.

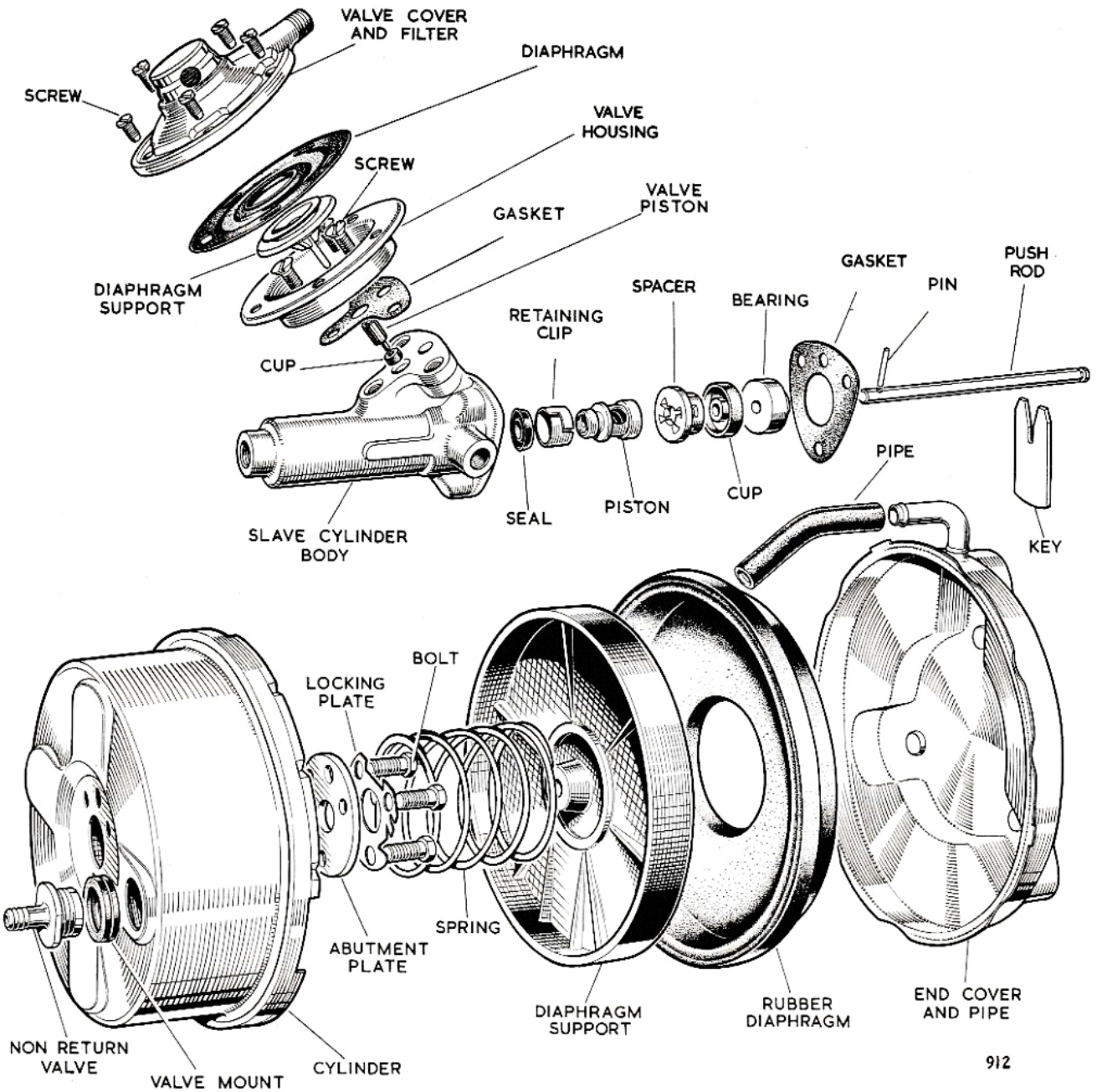
Use clean brake fluid as a lubricant for assembling components of the hydraulic parts of the servo.

Insert the push rod, chamfered end first, into the skirt in the rear of the slave piston. Depress the spring inside the piston to uncover the hole through the rod. Fit the retaining pin and release the spring to bear on the protruding ends of the pin. Slide on the pin retaining clip ensuring that it is positioned snugly and not exceeding the outer diameter of the piston, otherwise the bore will be scored.

With the fingers only, bed the rubber seal evenly into the groove on the head of the piston, the lips of the seal pointing away from the push rod.

Check that the bores of the slave cylinder are coated with clean brake fluid. Insert the piston, taking care not to bend over the lips of the seal on entering the bore. Follow with the spacer, the rubber cup and bearing by sliding them independently over the push rod into the mouth of the bore. Bed each part evenly and separately ensuring that the lips of the rubber cup point into the bore and are not turned back.




VALVE COVER AND FILTER
DIAPHRAGM
SCREW
VALVE HOUSING
SCREW
GASKET
VALVE PISTON
DIAPHRAGM SUPPORT
GASKET
PUSH ROD
SPACER
PIN
BEARING
RETAINING CLIP
CUP
PIPE
SEAL
PISTON
CUP
KEY
SLAVE CYLINDER BODY
BOLT
LOCKING PLATE
SPRING
ABUTMENT PLATE
DIAPHRAGM SUPPORT
RUBBER DIAPHRAGM
END COVER AND PIPE
NON RETURN VALVE
VALVE MOUNT
CYLINDER
912

With the lips pointing away from the drilled head of the air valve piston, use the fingers to position the rubber cup on the piston spigot. Insert the piston fully into its bore, spigot first, being careful to avoid bending over the lips of the cup.

Grip the slave cylinder in a soft jawed vice, at an angle of 45° with the mouth of the bore uppermost. Place the gasket on the mounting face of the cylinder before putting the servo shell in position. Position the abutment plate and locking plate (which need not be replaced if used only once previously) inside the shell and insert the three mounting bolts, tightening them evenly to a torque of 13 lb./ft. Bend over the ears of the locking plate to secure the bolts.

Insert the main return spring with the first coil spaced around the abutment plate. Pull the push rod out to its limit before fitting the diaphragm support.

Check that the main return spring is located correctly against the diaphragm support, with the central projection of the support inside the end coil and with the key slot uppermost. Gently press the support into the shell against the resistance of the return spring until the groove in the end of the push rod is visible through the slot. Insert the key. When fully home, the key will retain the push rod and will be flush with the groove on the exposed face of the diaphragm support. Make sure that the rubber servo diaphragm is completely dry especially in the vicinity of the centre hole **where there must be no trace of lubricant.** Likewise, the diaphragm support particularly at the groove.

Fit the rubber diaphragm to the support, carefully bedding the inner edge correctly and evenly in the groove. Gentle stretching of the diaphragm away from the centre will be found helpful in seating the lip. Note that the diaphragm also acts as a retainer for the key.

Smear the outer edge of the rubber diaphragm with LOCKHEED Disc Brake Lubricant where it will contact the rim of the end cover and of the shell. Bed the edge of the diaphragm evenly around the rim of the shell.

Secure Churchill tool No. C.2030 on the end cover. Line up the end cover with the shell so that the elbow is in the correct position relative to the mounting for the air valve. Whilst maintaining a downward pressure on the cover and being careful not to trap the rubber diaphragm with its edge, turn the cover clockwise as far as the stops will allow. Take off the Churchill tool.

Reposition the servo in the vice so that the mounting flange for the air valve assembly on the slave cylinder is facing upwards and horizontal.

Locate the gasket and then the valve housing on the mounting face. Secure firmly with the three screws, tightening them to a torque of 6 lb./ft. Insert the diaphragm support, spigot first, into the drilled head of the air valve piston.

Carefully position the inner edge of the rubber air valve diaphragm in the groove of the diaphragm support and line up the slots in the outer edge of the diaphragm with the screw holes in the valve housing. **Do not use lubricant of any kind when fitting the diaphragm.**

If the filter has been removed for inspection, replace it and snap fit the dome onto the valve cover.

Place the valve cover over the diaphragm making sure that the projections on the under surface of the cover engage in the slots of the diaphragm. Insert the five self-tapping screws through the holes in the cover and firmly tighten them diametrically and progressively. Do not over-tighten. **This is important, as the smallest amount of air leakage into the air valve assembly will impair the action of the servo.**

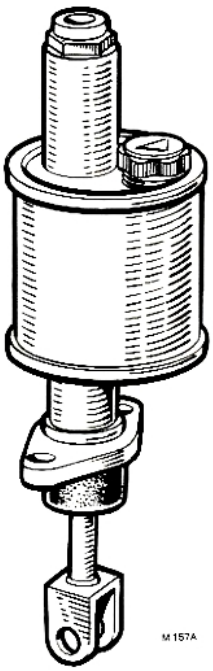
Reconnect the rubber pipe to join the end cover elbow with the valve cover port.

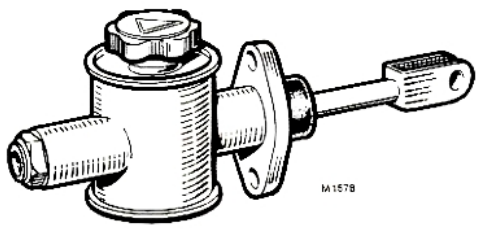
Finally, thoroughly inspect the servo unit to verify correct reassembly.

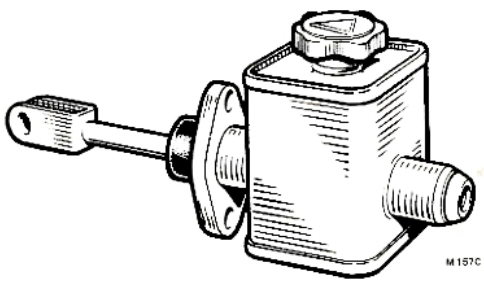
LOCKHEED

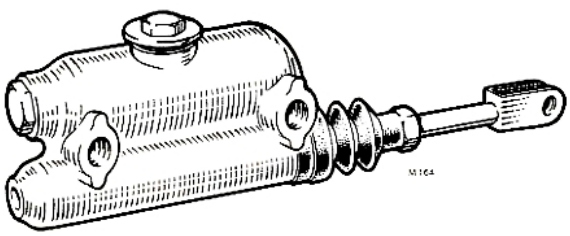
brake and clutch master cylinders

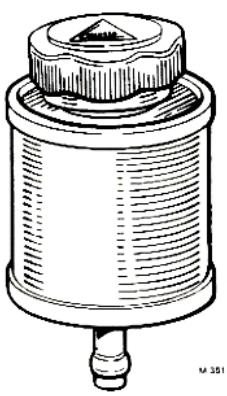
SECTION 6A

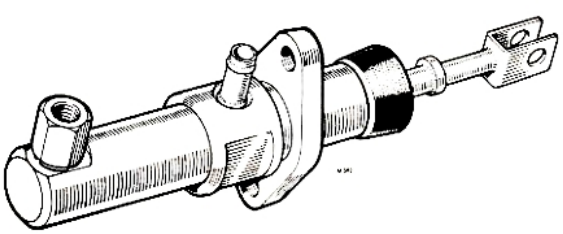












DESCRIPTION

Although the external appearance, shape and size of master cylinders may vary to suit specific vehicle nstallations, the internal working parts are very similar. Typical assemblies are illustrated on Page 1.

The essential difference between a brake and a clutch master cylinder, is that the latter does not normally incorporate a trap valve. Where there is a likelihood of confusion, due to a similarity of external appearance, the brake and clutch master cylinders are usually identified by an etched 'B' or 'C' on the respective barrel.

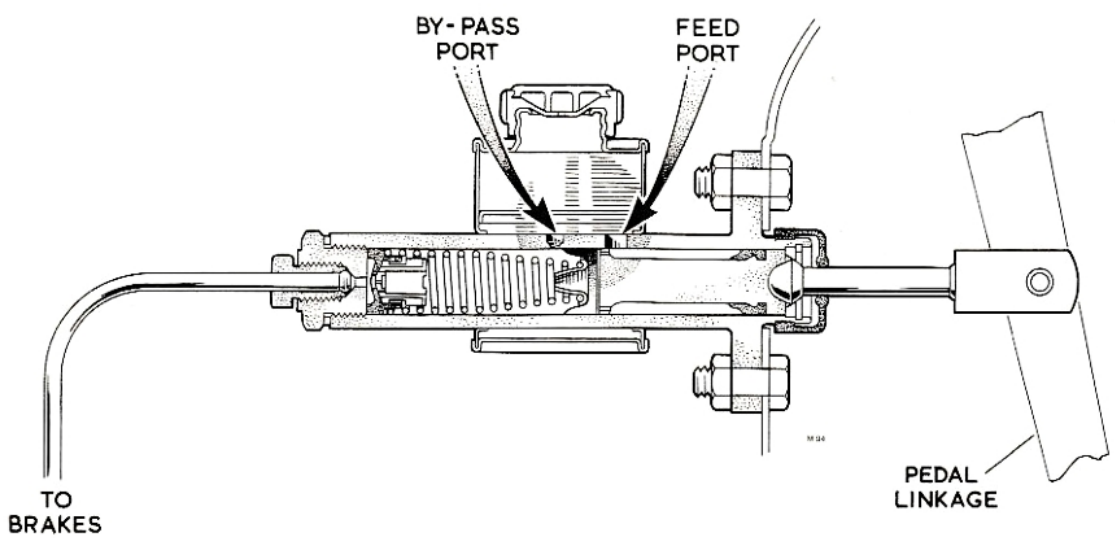
OPERATION

When the brake or clutch pedal is depressed, the push rod moves the piston along the cylinder bore. The fluid is thus displaced under pressure to operate the respective system.

On releasing the load on the pedal, the return spring moves the piston back towards its end stop faster than the fluid is displaced to the master cylinder. This causes the lip of the main rubber cup to relax, allowing fluid to pass over the cup from behind the piston head. The holes drilled in the head of the piston provide passages for the fluid, which are uncovered during the withdrawal of the piston along the bore.

When the piston is fully back against its stop, the main cup uncovers a small by-pass port in the barrel which releases all pressure within the master cylinder. The by-pass port also allows for expansion or contraction of the fluid caused by changes in temperature.

The trap valve checks the return of fluid to the master cylinder during 'bleeding'; this ensures a fresh charge of fluid every time the piston is stroked and consequently assists the purge of air from the system.



THE MASTER CYLINDER EXCHANGE SERVICE, OPERATED BY AUTOMOTIVE PRODUCTS COMPANY LIMITED, PROVIDES A FACILITY FOR SPEEDY AND CORRECT REPLACEMENT. The cylinders are assembled and tested at the factory ready for instant fitting to the vehicle. However, if it is decided to strip and to inspect the assembly, the procedure detailed below must be followed.

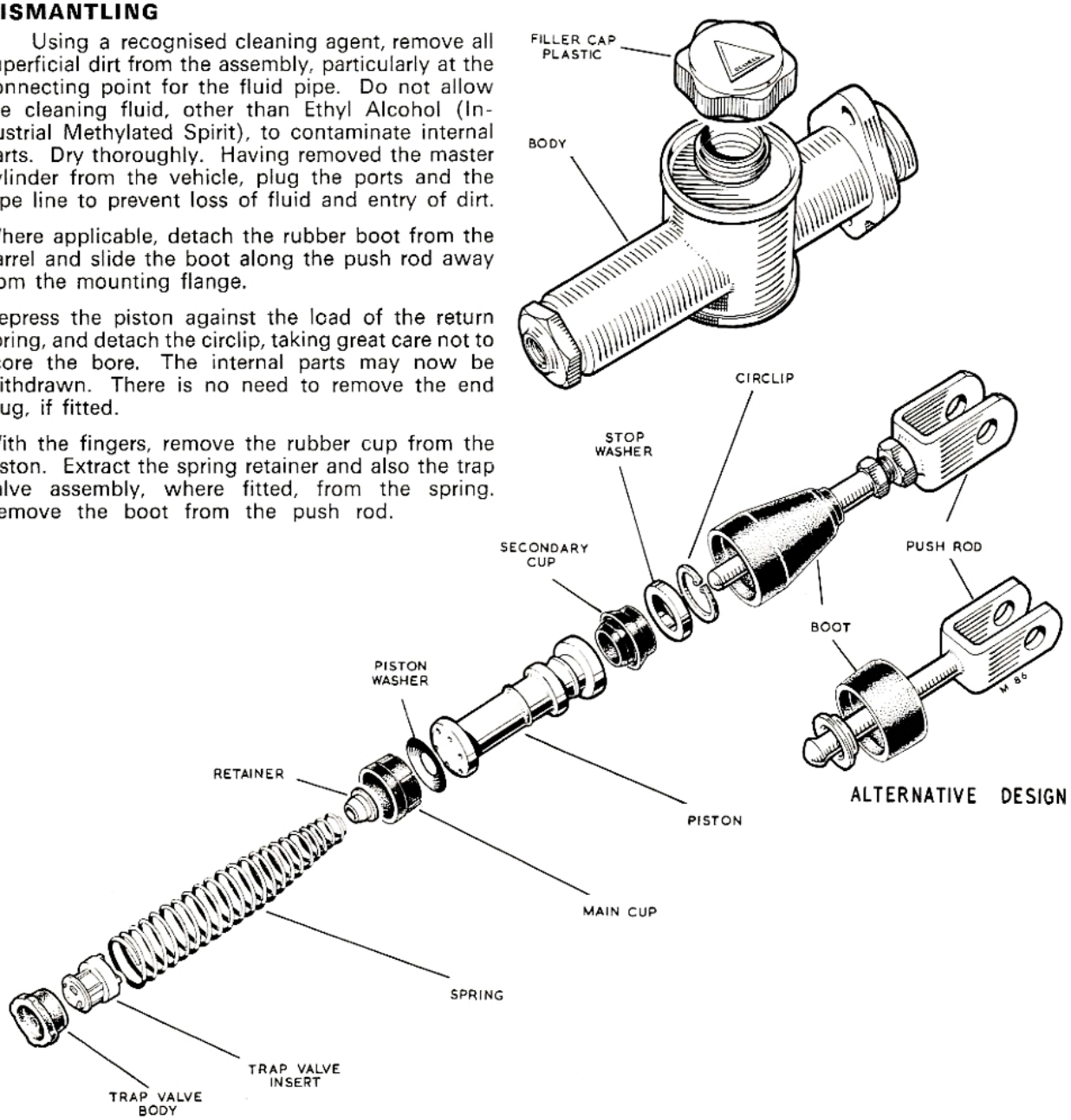
DISMANTLING

Using a recognised cleaning agent, remove all superficial dirt from the assembly, particularly at the connecting point for the fluid pipe. Do not allow the cleaning fluid, other than Ethyl Alcohol (Industrial Methylated Spirit), to contaminate internal parts. Dry thoroughly. Having removed the master cylinder from the vehicle, plug the ports and the pipe line to prevent loss of fluid and entry of dirt.

Where applicable, detach the rubber boot from the barrel and slide the boot along the push rod away from the mounting flange.

Depress the piston against the load of the return spring, and detach the circlip, taking great care not to score the bore. The internal parts may now be withdrawn. There is no need to remove the end plug, if fitted.

With the fingers, remove the rubber cup from the piston. Extract the spring retainer and also the trap valve assembly, where fitted, from the spring. Remove the boot from the push rod.



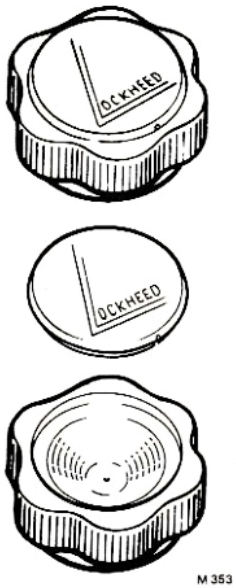
ALTERNATIVE DESIGN

Examination

Clean all parts thoroughly with clean LOCKHEED brake fluid. Carefully inspect all components for faults and wear. A replacement assembly will be required where the bore of the old cylinder, after cleaning, shows the slightest signs of corrosion or scoring.

Check that the vent in the filler cap of the supply tank is clear.

If the metal parts of the original cylinder are found to be in perfect condition, be prepared to fit new rubber parts. These are available in repair kit form.



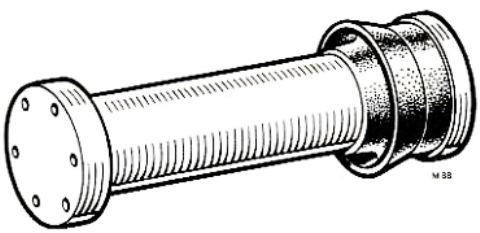
M 353

REASSEMBLING

In order of assembly, lay out the parts on a sheet of paper spread over the work bench. Make sure the hands are free of grease and dirt.

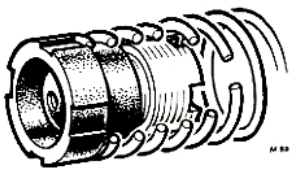
Use clean LOCKHEED brake fluid as a lubricant for the cylinder bore and for the rubber cups. The rubber protective boot should be positioned on the push rod and filled with LOCKHEED 'Rubberlube' before fitting the boot to the cylinder body.

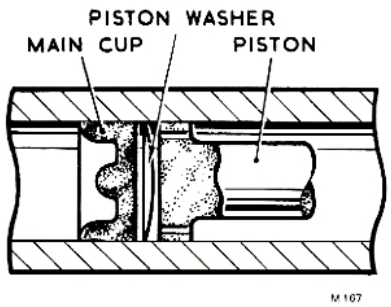
Using the fingers only, fit the new rubber cup to the piston with the lip towards the drilled head of the piston. Ensure the cup is bedded correctly.


M 88

Locate the trap valve, where fitted, in the larger diameter coils of the return spring. Place the spring retainer in the other end of the spring. Insert the parts into the cylinder bore, trap valve first. Check that the retainer does not topple out of position.

With the lips leading, push the new main rubber cup into the bore until the spring retainer seats in the well of the cup. Take care not to turn back the lip of the cup during insertion.





M 167

Locate the piston washer, concave surface first, on top of the main rubber cup. Follow with the piston, drilled head leading.

Place the push rod assembly in position and use it to press the piston into the cylinder bore, carefully guiding the piston to avoid bending back the lip of the piston rubber cup.

Locate the stop washer in the counter bore clear of the circlip groove. Fit the circlip. Check that it is seated correctly to hold the stop washer captive, and also the push rod where applicable.

Operate the push rod a few times to check movement of the piston. **Recheck the security of the circlip.** Gently stretch the rubber protective boot over the forked end of the rod, where applicable. Ensure that the boot is adequately filled with 'Rubberlube' before bedding the beaded inner edge in the groove on the cylinder body.

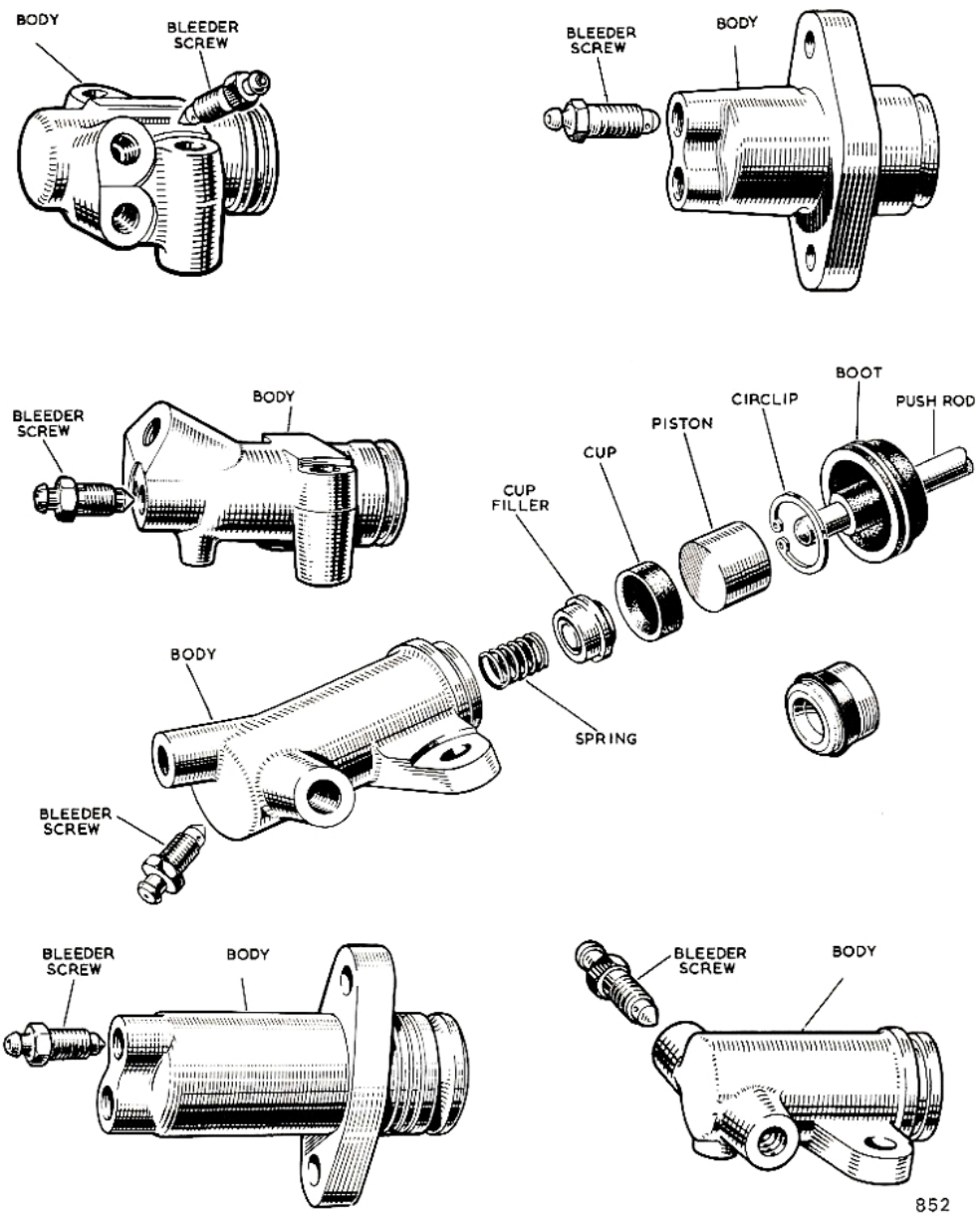
Remount the master cylinder on the vehicle. Reconnect the fluid pipe to the end of the cylinder by tightening the tube nut sufficient to prevent leakage. Do not over-tighten.

Bleed the system thoroughly as detailed in Section 11. Replenish the supply tank with fluid to the correct level. Check for leaks with the foot pedal fully depressed, and also with the system at rest.

LOCKHEED

clutch slave cylinders

SECTION 7



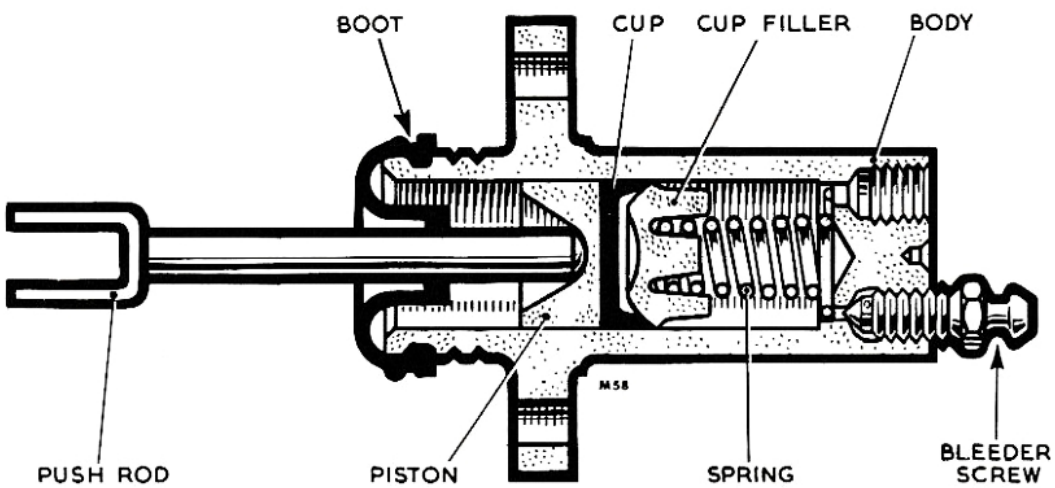
DESCRIPTION AND OPERATION

The external appearance of the slave cylinder varies according to vehicle application. Typical slave cylinders are illustrated on Page 1.

A single piston is fitted in the bore of the cylinder. The cylinder body has two threaded ports, one of which is occupied by a bleeder screw.

Against the inner face of the piston in most types of cylinder, a rubber cup is loaded by a cup filler and spring. An alternative type has the rubber seal fitted on to the piston. A rubber boot, through which the push rod passes, fits on to the body to prevent the entry of dirt and moisture.

When the clutch pedal is depressed, the fluid passes under pressure from the clutch master cylinder through the port in the slave cylinder, to move the piston down the bore. The push rod is thus actuated to operate the clutch release mechanism.



OVERHAUL

THE EXCHANGE SERVICE OPERATED BY AUTOMOTIVE PRODUCTS COMPANY LIMITED PROVIDES A FACILITY FOR SPEEDY AND CORRECT REPLACEMENT. The cylinders are assembled and tested at the factory ready for instant fitting to the vehicle. However, if it is decided to strip and to inspect the assembly, the procedure detailed below must be followed.

DISMANTLING

Using a recognised cleaning agent, remove all superficial dirt from the assembly, particularly at the connection point for the fluid pipe. Do not allow the cleaning fluid other than Ethyl Alcohol (Industrial Methylated Spirit) to contaminate internal parts. Dry thoroughly.

Having removed the slave cylinder from the vehicle, plug the exposed port and the pipe line still attached to the vehicle to prevent loss of fluid and entry of dirt.

Detach the rubber boot from the barrel. Where applicable, depress the piston and extract the circlip, if fitted, taking great care not to score the bore. The internal parts may now be withdrawn, if necessary by applying a **low** pressure air line to the open port on the body. Remove the bleeder screw.

If the piston is seized in the bore, the whole assembly must be renewed.

Where relevant, remove the rubber cup from the piston with the fingers only.

Examination

Clean all parts to be reassembled with new LOCKHEED brake fluid. Carefully inspect the metal parts for imperfections. A replacement assembly will be required where the bore and piston, after cleaning, show the slightest signs of corrosion or scoring. If the parts of the original cylinder are found to be in perfect condition, be prepared to fit new rubber components. These are available in repair kit form from all Automotive Products Company Limited stockists.

REASSEMBLING

In order of assembly, lay out the parts on a sheet of paper spread over the work bench. Make sure the hands are free of grease and dirt.

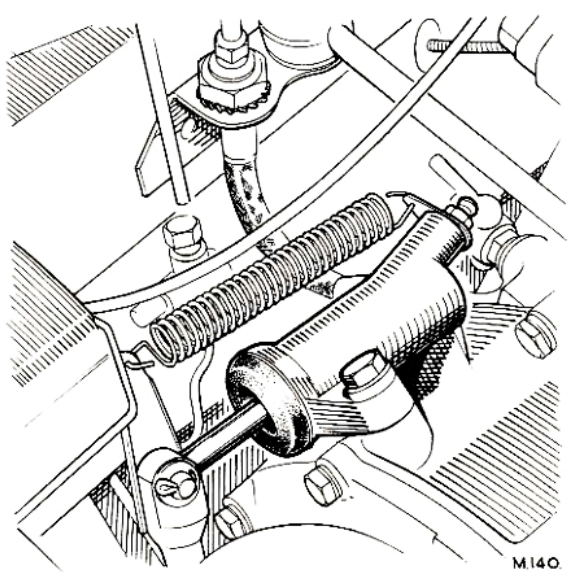
Use clean LOCKHEED Super Heavy Duty brake fluid as a lubricant for the cylinder bore and rubber cup. The rubber protective boot should be filled with LOCKHEED 'Rubberlube' before fitting the boot to the cylinder body.

Where applicable, and using the fingers only, fit the new rubber cup onto the piston, with the lip facing away from the push rod end of the piston.

Insert the internal parts in the correct order as shown in the relevant illustration, taking great care not to turn back the lip of the rubber cup during the process. If fitted, replace the circlip, ensuring that it is properly located in the groove.

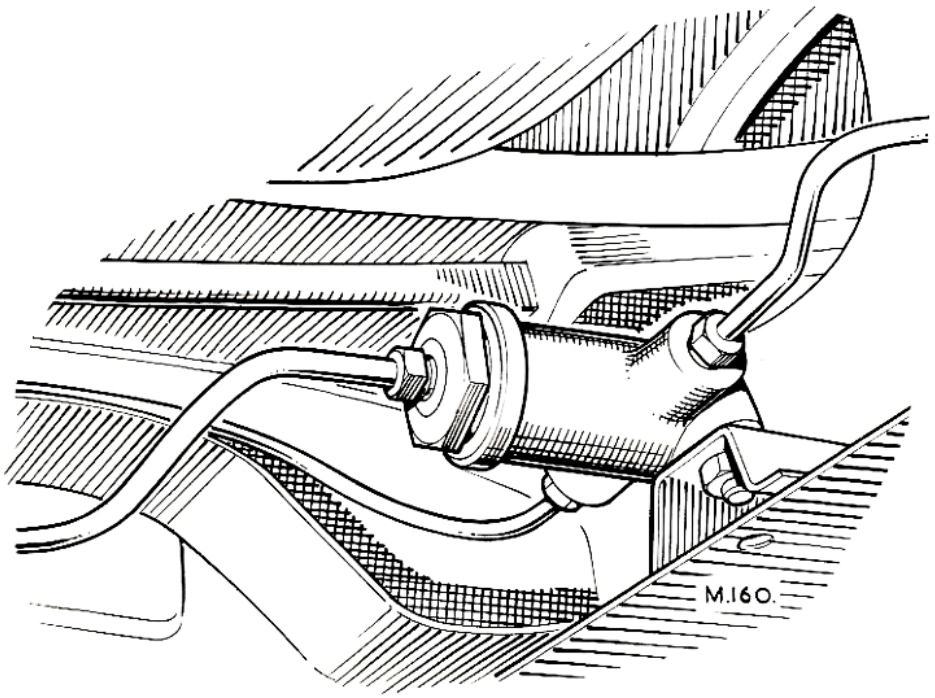
Gently stretch the protective boot over the forked end of the push rod, where applicable. Ensure that the boot is filled with LOCKHEED 'Rubberlube' before bedding the beaded inner edge in the groove on the cylinder body. Screw in the bleed screw finger tight.

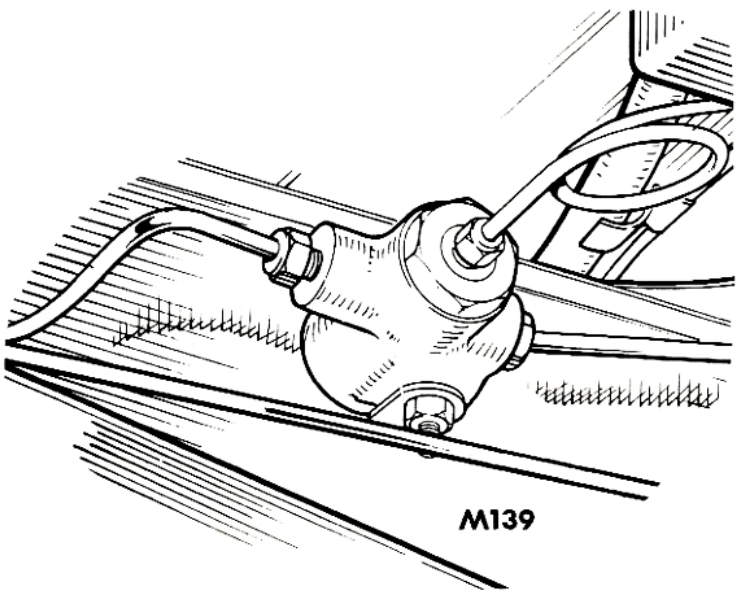
Remount the assembly onto the vehicle. Reconnect the fluid pipe or hose to the port by tightening sufficiently to prevent leakage. Do not overtighten. Bleed the system as detailed in Section 11. Replenish the supply tank with fluid to the correct level. Check for leaks with the foot pedal fully depressed, and also with the system at rest.


M.140.

LOCKHEED
pressure regulating valves

SECTION 8

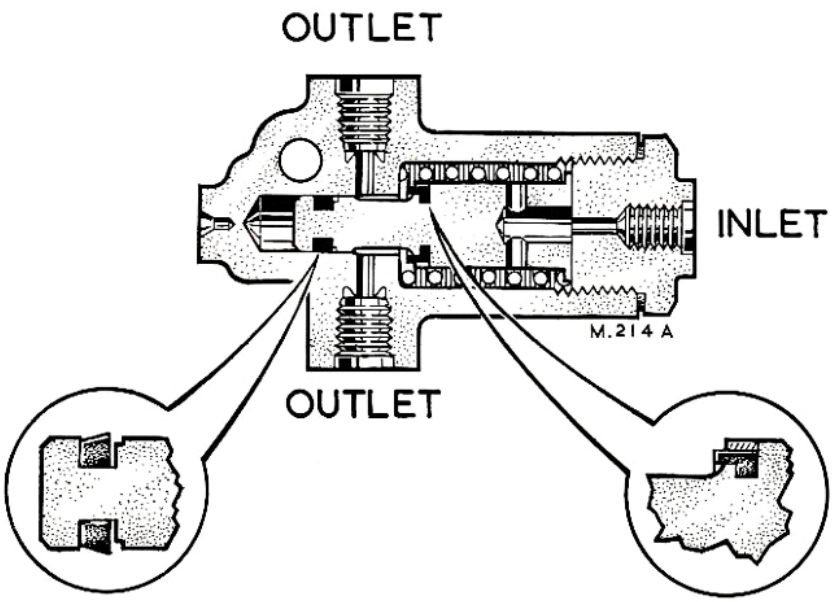


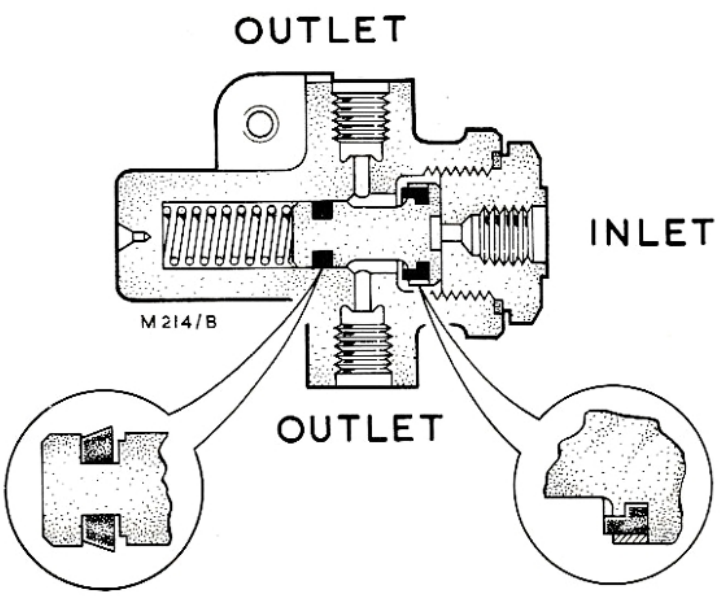


DESCRIPTION AND OPERATION

The LOCKHEED pressure regulating valve is incorporated in the fluid line to the rear brakes on some vehicles to reduce the possibility of rear wheel skidding due to weight transfer during braking.

With light brake application, fluid from the master cylinder under pressure passes through the valve and operates the rear brakes in the normal manner. As the fluid pressure increases following greater effort on the brake pedal and exceeds a predetermined value, the spring loading on the plunger is overcome, allowing the valve washer to seal off the valve outlet. Accordingly, increased line pressure will affect the front brakes only.



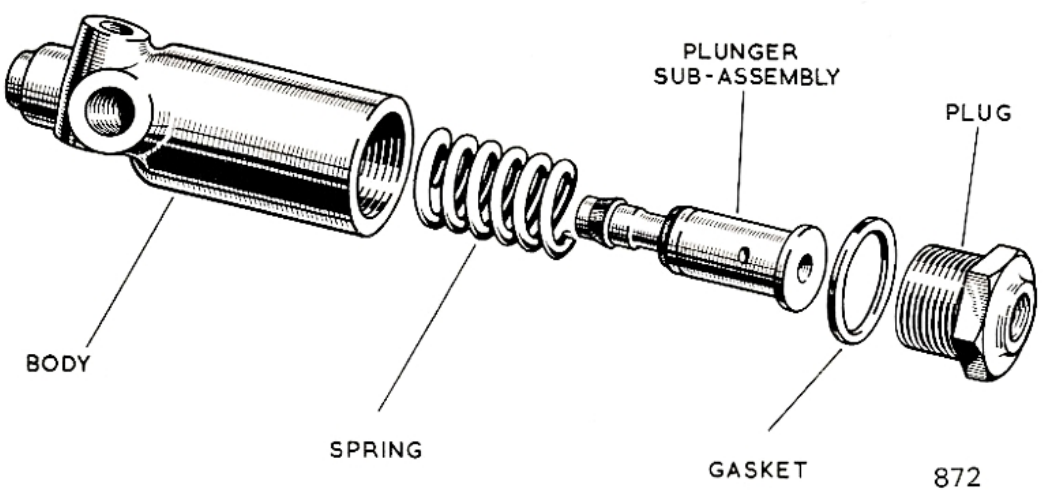


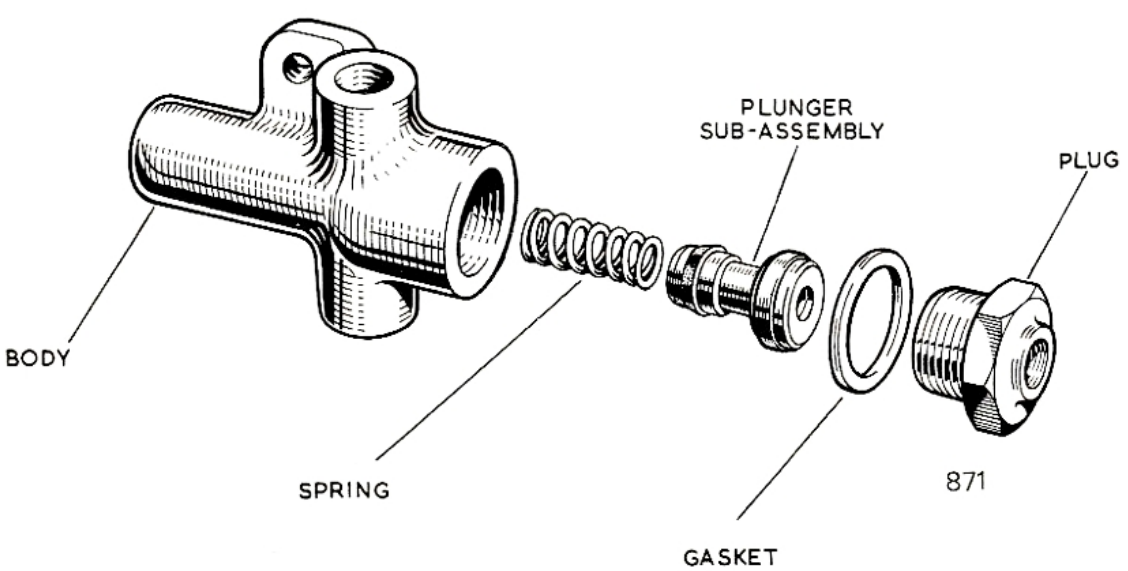
If the performance of the pressure regulating valve is suspect, the assembly should be replaced by an exchange unit obtainable from all Automotive Products Company Limited stockists. As the cut-off pressure of the valve varies with specific vehicle application, the exchange facility ensures a factory tested and correct replacement.

Should there be no alternative to overhaul of the assembly, the procedure detailed below must be followed.

DISMANTLING

Having removed the valve from the vehicle, plug the pipe lines to prevent loss of fluid and entry of dirt. Remove the end plug and washer and extract the plunger sub-assembly and spring from the bore.





Examination

Thoroughly clean all parts to be reassembled with clean LOCKHEED brake fluid or Ethyl Alcohol (Industrial Methylated Spirit). Dry thoroughly.

Carefully inspect the smaller diameter bore and the valve washer seat for imperfections. Provided they are found to be in perfect condition, be prepared to fit a new plunger sub-assembly and plug washer which are obtainable as a repair kit from all Automotive Products Company Limited stockists.

If the spring is suspect, it must be replaced with a new part.

REASSEMBLING

The bores of the valve body must be completely dry.

Insert the spring, followed by the plunger sub-assembly, having first wetted the seals with clean LOCKHEED brake fluid.

Make sure that the washer seating faces on the plug and valve body are clean and undamaged. Locate the new copper washer on the end plug.

Whilst maintaining pressure on the plunger assembly with the end plug against the loading of the spring, screw the part into the body and tighten to a torque of 50 lb./ft.

Refit the assembly to the vehicle. Reconnect the fluid lines, and 'bleed' the system as detailed in Section 11.

Inspect for fluid leaks with the foot pedal fully depressed, and also with the system at rest.

Check the fluid level in the brake master cylinder supply tank before road testing the vehicle.

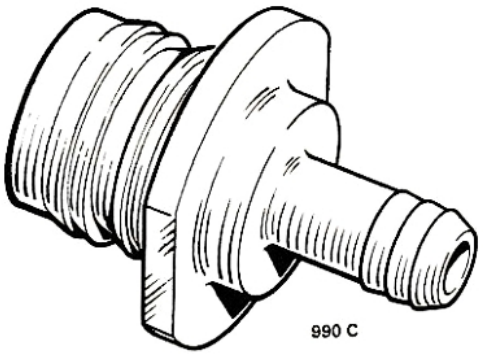
LOCKHEED

vacuum non-return valves

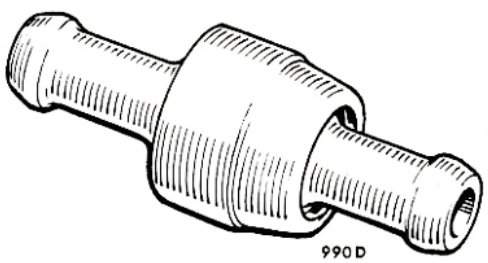
SECTION 9

The purpose of the non-return valve is to sustain vacuum in the servo, and to prevent variation in servo performance due to fluctuation of manifold depression which provides the source of the vacuum. According to vehicle application, one or more of the types illustrated may be fitted as original equipment.

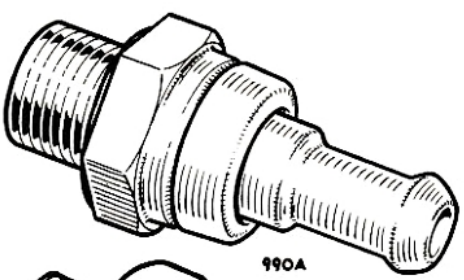
The principle of operation for all types of vacuum non-return valves is similar. The illustrations show that a simple spring loaded internal valve is the only moving part. However, it is not possible to overhaul the assembly except the type used for the supplementary vacuum reservoir tank, parts for which are available from all Automotive Products Company Limited stockists. Suspect functioning of the other types must be remedied by fitting a new valve assembly also supplied by the stockists.



990 C

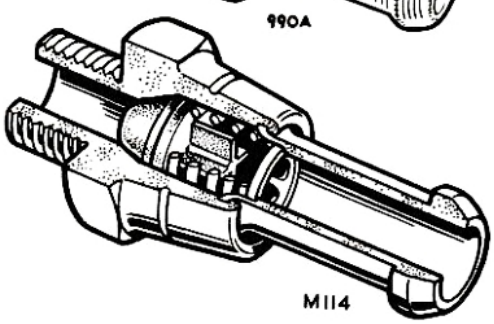


990 D



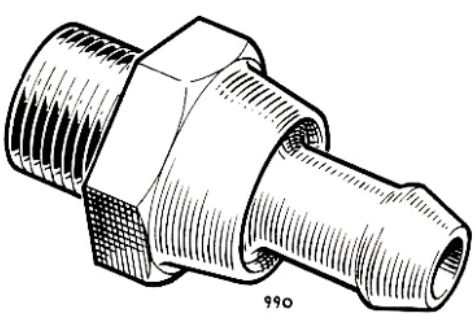
990A

The valve having a groove machined around the body must always be installed in the slave cylinder of the relevant servo unit. This type of valve must not be mounted in the induction manifold of the engine, otherwise the vacuum source will be isolated from the servo.

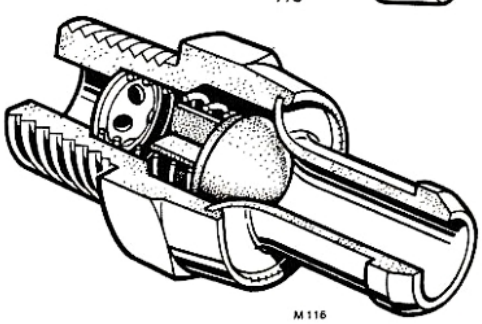


M114

The type of valve portrayed in the adjacent illustration is always fitted in the induction manifold of the engine.

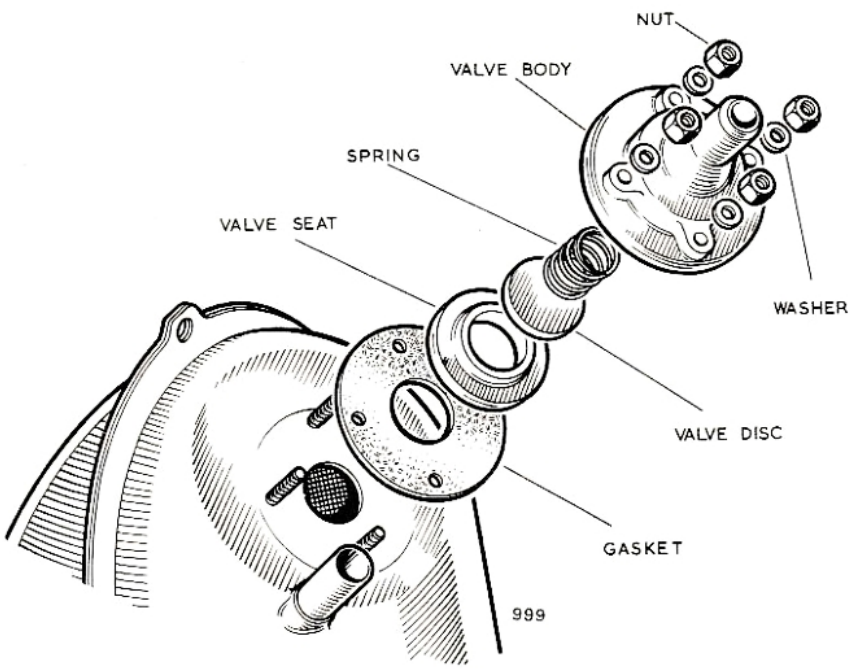


990



M116

When reassembling the valve fitted to the supplementary vacuum reservoir, the nuts securing the valve body should be tightened progressively and evenly to a torque of 35 lb./in. Do not overtighten.



LOCKHEED
bleeding and flushing

SECTION 11

BLEEDING PROCEDURE

Purging of air from a hydraulic system, commonly known as 'bleeding', should only be necessary when some part of the system has been disconnected, or after the fluid has been drained off and renewed. However, in normal service, should the presence of air in the system be indicated by a 'spongy' brake pedal effect, the cause should be traced and rectified immediately.

BRAKING SYSTEM

If a vacuum servo is fitted, the brake pedal must be actuated several times to destroy the vacuum in the servo unit and in the vacuum reservoir, where fitted.

Fill the master cylinder supply tank with the appropriate LOCKHEED fluid, and keep topped up throughout the operation, otherwise air may be drawn into the system, necessitating a fresh start.

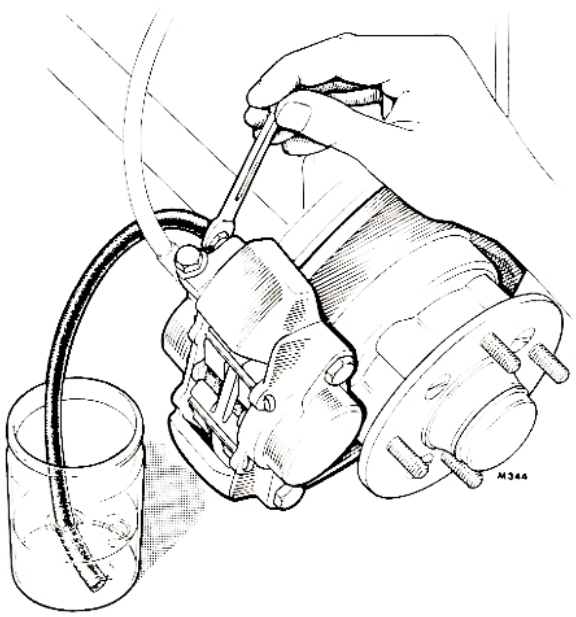
Attach a flexible tube to the bleeder screw of the hydraulic unit, and allow the other end of the tube to be submerged in a small quantity of new fluid contained in a glass jar. Open the bleeder screw half a complete turn.

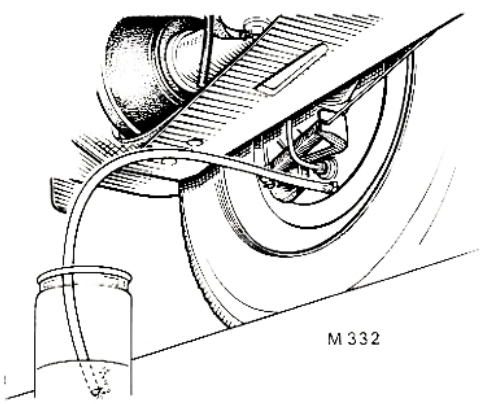
Depress the brake pedal slowly, allowing it to return unassisted. It is particularly important to depress the pedal slowly where an inertia valve is incorporated in the system, as a rapid movement will tend to lift the ball inside the assembly, thus closing the valve, and preventing flow of fluid to the rear brake assemblies. Repeat the pumping action, with a slight pause between each stroke. When clear fluid, free of air bubbles emerges from the tube, tighten the bleeder screw whilst the brake pedal is fully depressed.

Repeat the operation at the brake assemblies for the other wheels.

Verify that the master cylinder supply tank is replenished to the correct level.

FLUID BLED FROM THE SYSTEM MUST BE DISCARDED.





CLUTCH OPERATING SYSTEM

Fill the master cylinder supply tank with LOCKHEED Super Heavy Duty brake fluid, and keep topped up throughout the operation, otherwise air may be drawn into the system, necessitating a fresh start.

Attach a flexible tube to the bleeder screw in the clutch slave cylinder, and allow the other end of the tube to be submerged in a small quantity of new fluid contained in a glass jar.

Open the bleeder screw half a complete turn. Depress the clutch pedal slowly. Tighten the bleeder screw as the pedal reaches the end of the down stroke, and then allow the pedal to return unassisted. Repeat this sequence with a slight pause between each down stroke of the pedal, until clear fluid, free of air bubbles, emerges from the tube.

Tighten the bleeder screw whilst the clutch pedal is fully depressed.

Verify that the master cylinder supply tank is replenished to the correct level.

FLUID BLED FROM THE SYSTEM MUST BE DISCARDED.

FLUSHING PROCEDURE

Every 18 months, or after every 24,000 miles, whichever occurs first, the fluid in the hydraulic systems should be renewed with the appropriate LOCKHEED brake fluid.

Brake fluid, particularly disc brake fluid, absorbs water from the atmosphere; accordingly, fluid must only be exposed during the time taken to fill the system. It is also most important that the greatest care is taken to prevent dirt from entering the system during the filling operation.

Follow the 'bleeding' procedure until new clean fluid emerges from the flexible tube, thus establishing complete renewal of the fluid.

If the fluid in the system is contaminated by mineral oil or other spurious fluid, the complete hydraulic system must be stripped. Hydraulic assemblies must be renewed or overhauled as detailed in the appropriate section of this manual, and flexible hoses replaced. Furthermore, ensure that all metal fluid pipes are cleaned thoroughly before reassembling.

LOCKHEED
flexible hoses

SECTION 12

Hoses must be inspected every 10,000 miles for signs of leakage, chafing or general deterioration. Where there is doubt of serviceable condition, renew immediately. In any case, it is recommended that all hoses be renewed at least every 3 years or at every interval of 40,000 miles, whichever occurs first.

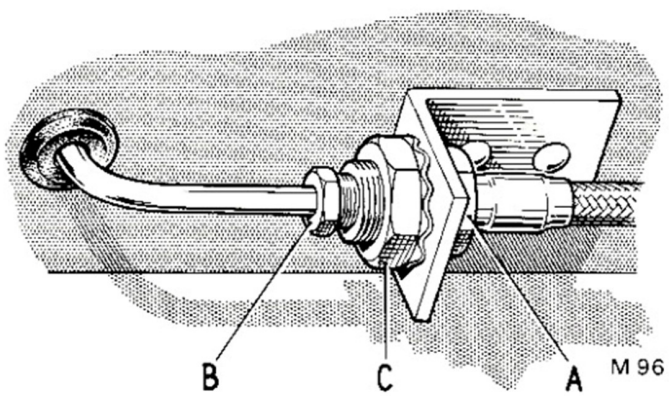
When checking hoses, also inspect all metal fluid pipes for looseness and corrosion.

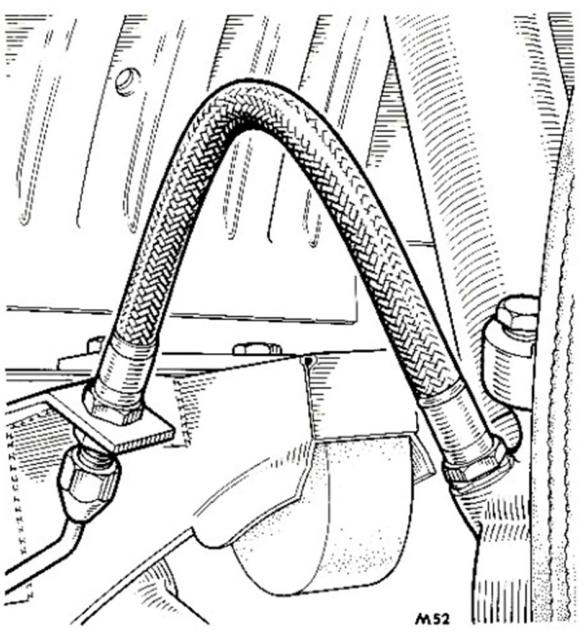
REMOVING

Unscrew the tube nut 'B'. Whilst holding hexagon 'A' to prevent the hose twisting, unscrew locknut 'C'. Remove the lock washer and extract the hose from the bracket.

Plug the end of the pipe still connected to the hydraulic system to prevent loss of fluid and entry of dirt.

Unscrew the other end of the hose, which will usually be connected to a caliper, wheel cylinder or slave cylinder assembly, and plug the exposed port. Discard the old copper washer.





FITTING

Using a new copper washer, fit the hose to the hydraulic assembly, tightening sufficiently to prevent fluid leakage. Do not overtighten.

Next pass the hose union through the mounting bracket, and whilst holding the union 'A' with a spanner to prevent the hose twisting, fit the lock-washer and locknut 'C'. **It is most important that the hose is not twisted or kinked, and is clear of all parts likely to cause chafing.**

Reconnect the fluid pipe by screwing in the tube nut 'B' sufficiently to prevent fluid leakage. Do not overtighten.